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Application of Green Architecture Principles in Condotel Design in Medan City

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ABSTRACT

This study aims to design a vertical residential building in the form of a condotel with a green architecture approach in the city of Medan. Medan, as the center of economic and administrative activities in North Sumatra, has experienced high population growth, resulting in land constraints. Thus, the concept of environmentally friendly vertical housing is a solution to meet housing needs while maintaining environmental balance. The research methods include literature studies and field surveys focused on site analysis, building analysis, and the application of green architecture principles. The design results show that the condotel building is designed to have two main functions, namely as a hotel and condominium, by applying six principles of green architecture: respect for the site, respect for users, working with the climate, energy conservation, minimizing new resources, and a holistic approach. The condotel building is expected to become a model of sustainable development in the urban area of Medan.

Keywords: Green Architecture, Condotel, Vertical Housing, Medan City

INTRODUCTION

Medan is the third largest city in Indonesia and is the center of economic activity and government administration in northern Sumatra. The rapid population growth in this city, reaching 0.89% per year with a population of more than two million, has triggered an increase in the need for proper housing. Limited land in urban areas has encouraged the community and developers to seek space-efficient housing alternatives, one of which is through the construction of vertical buildings such as apartments and flats.

The development of vertical housing is also driven by changes in the lifestyle of modern society, which prefers practical residences in strategic areas with complete facilities. One form of vertical housing that is now in high demand is the condotel (condominium hotel), which is a building that combines the functions of a condominium and a hotel. This concept allows units owned by individuals to be rented out like hotel rooms when not in use, so that in addition to serving as a place to live, they also become a means of investment.

However, the increasing number of vertical buildings in urban areas also has a significant environmental impact. These buildings contribute to increased energy consumption, carbon emissions, and a decline in air quality and green open spaces. To overcome this, a design approach is needed that can balance human needs with environmental sustainability. One relevant and sustainable approach is green architecture.

Green architecture focuses on energy efficiency, natural resource management, and user comfort through designs that are in

harmony with local environmental conditions. This approach encompasses six main principles, namely respecting the site, respecting users, working with the climate, conserving energy, minimizing the use of new resources, and using a holistic approach. With the application of these principles, the design of condotels in Medan is expected to not only create modern residences but also contribute to urban environmental sustainability.

This study aims to design a Condotel with a Green Architecture approach in Medan City as a sustainable vertical housing solution. This design is expected to become a model for the application of green building principles in densely populated urban areas, as well as provide inspiration for the development of environmentally friendly architecture in Indonesia.

LITERATURE REVIEW

Condotel Definition

According to Benioff in Nabila Khansa Afanin, a condotel is a combination of condominium and hotel characteristics that produces a residence with a hotel-like management system. When investors purchase one of the condotel units, when the owner does not occupy the purchased condotel unit, it will be included in the units that can be rented out like hotel rooms. The hotel is fully responsible for managing the rental of the units. The hotel and investor can then share the proceeds from the rental income.

Green Architecture

According to Roy in Alvian Bayu Permana, Green Architecture is an approach to building that minimizes adverse effects on human health and the environment. Green architects or designers strive to protect the air, water, and soil by choosing environmentally friendly building materials and construction practices. After Islam entered North Sumatra through trade, it began to spread and develop after the emergence of Islamic kingdoms. A number of prominent sultanates, such as the Langkat Sultanate, the Serdang Sultanate, the Deli Sultanate, and other Malay sultanates, further advanced the struggle to spread Islam in North Sumatra.

Green Building Construction

According to Karyono in Redi Sigit Febrianto, green architecture is a work that provides solutions to the environment and climate and must go through an approach in the field of building science. Energy savings, conservation, reducing emissions, increasing production, minimizing expenses, and increasing the added value of buildings.

Figure 1. Pekanbaru Park Condotel

Green architecture is a building design approach that aims to minimize negative impacts on the environment and human health. According to Brenda and Robert Vale (1991), the principles of green architecture consist of six main aspects, namely: respecting the site, respecting users, working with the climate, conserving energy, minimizing new resources, and applying a holistic approach. In addition, in accordance with Minister of Public Works and Public Housing Regulation No. 21 of 2021, Green Buildings must meet technical standards in site management, energy efficiency, water use efficiency, indoor air quality, use of environmentally friendly materials, and waste and wastewater management.

MATERIALS & METHODS

The design method used in this study consists of three main stages, namely:

A literature study discussing green architecture theories and principles as well as the characteristics of condotel buildings.
Field survey to collect data on the existing conditions of the design location on Jalan Gagak Hitam, Medan Sunggaland.
Based on an analysis of several criteria, in accordance with the Detailed Spatial Plan (RDTR) and the 2015-2035 Medan Zoning Regulations, Medan Sunggal has a High Density Residential Zone (R1) and a Trade and Services Zone, and meets the site criteria listed in the appendix to the Circular Letter of the Director General of Human Settlements Number: 03/se/dc/ 2023 concerning technical guidelines for assessing the performance of green buildings for building class 1a regarding criteria and benchmarks, which include Site Management, Water Use Efficiency, Accessibility, Waste Management, and Wastewater Management.

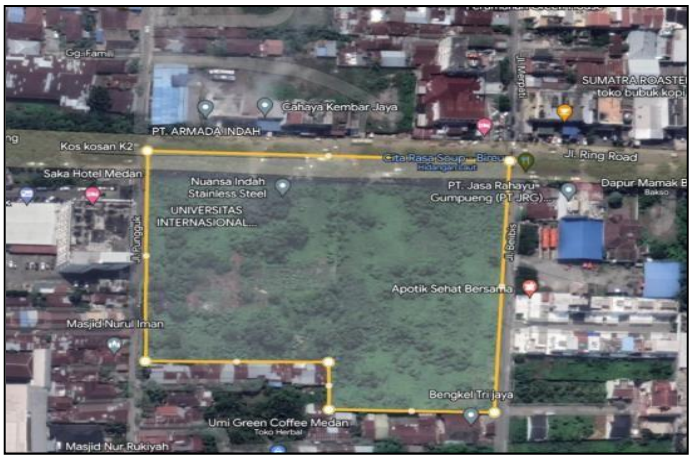

Figure 2. Site Location

Data analysis, including site analysis, circulation analysis, lighting analysis, and environmental analysis. The results of these analyses were used to develop a condotel building design concept with the application of green architecture principles.

RESULT

The Condotel design location is on Jalan Gagak Hitam, Medan Sunggal District, Medan City, with a land area of ±22,588 m². Based on the 2015–2035 Medan City Detailed Spatial Plan (RDTR), this area is included in the trade and services zone (K2) with a Building Floor Area Ratio (KDB) of 70%, a Floor Area Ratio (KLB) of 10, and a minimum Green Floor Area Ratio (KDH) of 20%.
The site is strategically located, easily accessible, and situated on a main city road. However, heavy traffic during working hours requires separate entrance and exit planning.

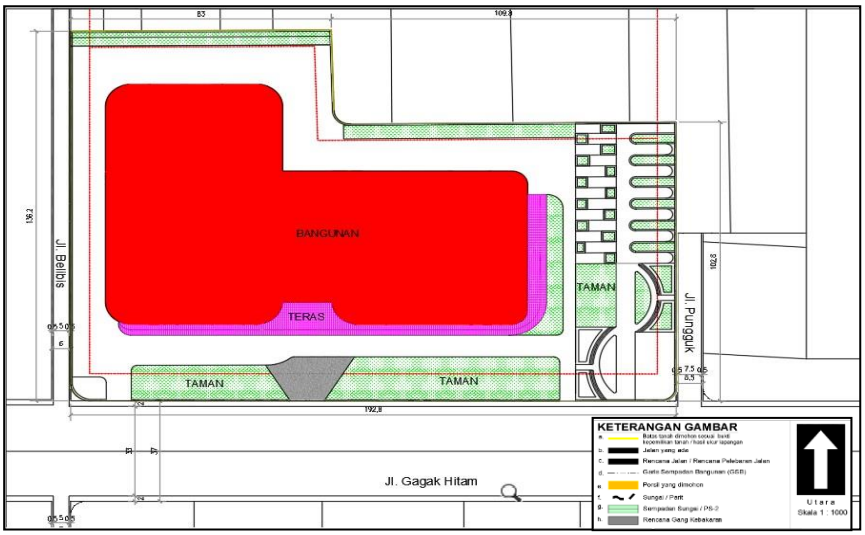

Figure 3. Zoining Area

The sun in this area comes from the east and west, so the sides of the building that are directly exposed need to be protected with adaptive facade elements (secondary skin, canopy, or vertical grilles).

The prevailing wind direction is from the northeast, which is utilized as natural ventilation to reduce the need for artificial cooling. In addition, buffer vegetation is planned on the west and north sides of the site to reduce noise and dust.

Figure 4. Analyzation of the Sun

The basic design concept refers to the principles of Green Architecture, namely "Working with Climate and Respect for Site". The building mass is elongated east-west to maximize natural lighting and cross ventilation.

The facade design integrates vertical vegetation, solar panels on the roof, and a rainwater retention pond as ecological elements. Green open spaces are located in the center of the site and are accessible to the public, creating a concept of human connection with nature (biophilic design).

This design shows that the application of green architecture principles can reduce electricity and clean water consumption by ±25% compared to conventional designs.

In addition, the integration of green open spaces and vertical vegetation also improves the thermal comfort and aesthetics of the building. Functionally, this condotel can serve as an example of green architecture implementation in densely populated urban areas such as Medan.

The application of green architecture principles is carried out through several strategies, including: (a) the use of environmentally friendly local materials, (b) the use of vegetation to reduce heat and noise, (c) natural lighting systems through controlled openings, (d) the use of recycled grey water for landscape irrigation, and (e) adaptive facade designs that take into account solar orientation. Overall, this condotel design is expected to provide comfort for users while reducing negative impacts on the environment.

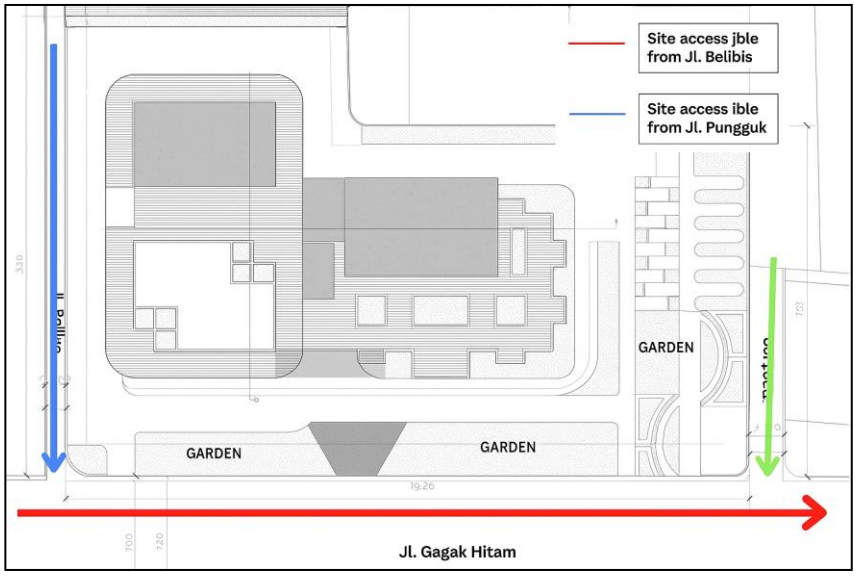

Figure 5. Outcome Concept

DISCUSSION

The application of green architecture principles in the design of the condotel in Medan demonstrates a comprehensive effort to integrate environmental sustainability with modern urban development. The findings show that the design not only meets the functional requirements of a condotel a hybrid of condominium and hotel but also addresses the environmental challenges associated with high-density urban construction.

The design's orientation, which stretches along the east–west axis, effectively utilizes natural lighting and cross-ventilation. This spatial strategy reduces the dependence on artificial lighting and air conditioning, aligning with the "Working with Climate" principle. The incorporation of vertical vegetation and green roofs also contributes to the reduction of the urban heat island effect, while enhancing building aesthetics and the psychological comfort of users. Such an approach aligns with the concept of biophilic design, which emphasizes the connection between humans and nature within built environments.

From a broader perspective, the condotel design serves as a prototype for sustainable vertical development in urban Indonesia. As Medan continues to grow as an economic hub, the need for environmentally responsible design becomes increasingly urgent. The project highlights that sustainability is not only an environmental imperative but also an economic and social opportunity. By adopting green architecture principles, developers can create value-added properties that appeal to environmentally conscious investors and occupants while reducing operational costs over the building's life cycle.

In conclusion, the study reinforces that applying green architecture principles can effectively transform urban development patterns. Through thoughtful design decisions ranging from building orientation and material selection to water and energy management the condotel project provides a practical model for sustainable architecture in tropical urban contexts. The implementation of such designs in Medan could serve as a catalyst for wider adoption of green building practices across Indonesia's rapidly urbanizing cities.

CONCLUSION

The design of a condotel using a green architecture approach in the city of Medan has resulted in a vertical building concept that combines residential and commercial functions while taking environmental sustainability into account. The application of green architecture principles has been proven to increase energy efficiency, optimize natural lighting, and create thermal comfort for residents. This design is expected to serve as an example of green architecture development in densely populated urban areas such as the city of Medan.

Declaration by Authors

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