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The Application of Behavioral Architecture Design in the Design of Rusunawa as a Sustainable and Affordable Housing Alternative in Surabaya

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ABSTRACT

The city of Surabaya is the capital of East Java Province. As a result, villagers looking for work are turning to the city. This triggered a large migration flow and the need for housing, leading to the emergence of illegal settlements in urban areas. One of them is Dupak Magersari Village, Jepara Village, Bubutan District. To overcome this problem, the government provides decent housing for low-income people (MBR) in the form of rental flats *(rusunawa)*. However, low-cost flats often face issues such as poor maintenance, leaky roofs and pipes, and uncomfortable living environments. Therefore, behavioral architecture approaches are used in the planning and design of *rusunawa* as an alternative to sustainable and affordable living. This approach considers the relationship between a person's behavior and the surrounding environment. The design is made through macro and micro studies, such as accessibility for all groups, connectivity between buildings, forms that adapt to the concept of village, and flexible shared spaces according to the needs of residents. It is hoped that its implementation can create a safe and comfortable environment to live in, in harmony with the surrounding community and nature.

Keywords: *affordable; behavioral architecture; rental flats; sustainable*

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ABSTRACT

Kota Surabaya adalah Ibu Kota Provinsi Jawa Timur. Akibatnya, penduduk desa yang mencari pekerjaan beralih ke kota. Hal ini memicu arus migrasi yang besar dan kebutuhan akan perumahan, menyebabkan munculnya pemukiman ilegal di daerah perkotaan. Salah satu di antaranya adalah Kampung Dupak Magersari, Desa Jepara, Kecamatan Bubutan. Untuk mengatasi masalah ini, pemerintah menyediakan perumahan layak bagi masyarakat berpenghasilan rendah (MBR) dalam bentuk rumah susun sewa (rusunawa). Namun, rusunawa dengan biaya rendah sering menghadapi masalah seperti pemeliharaan yang buruk, atap dan pipa yang bocor, serta lingkungan tempat tinggal yang tidak nyaman. Oleh karena itu, pendekatan arsitektur perilaku digunakan dalam perencanaan dan desain rusunawa sebagai alternatif untuk tinggal yang berkelanjutan dan terjangkau. Pendekatan ini mempertimbangkan hubungan antara perilaku seseorang dan lingkungan sekitarnya. Desain dibuat melalui kajian makro dan mikro, seperti aksesibilitas bagi semua kalangan, keterhubungan antar-bangunan, bentuk yang mengadaptasi konsep kampung, serta ruang bersama yang fleksibel sesuai kebutuhan penghuni. Implementasinya diharapkan dapat menciptakan lingkungan yang aman dan nyaman untuk ditinggali, selaras dengan masyarakat sekitar dan alam.

Keywords: *arsitektur perilaku; berkelanjutan; rusunawa; terjangkau*

INTRODUCTION

Surabaya, the capital of East Java Province, is a primary destination for rural communities seeking employment. Rapid urbanization has led to increased population growth, but this has not been matched by land availability. Based on BPS data, population density increased from 7,568 people/km² in 1990 to 8,462 people/km² in 2010 [1]. Land constraints and high land prices have led many low-income residents to build homes on illegal land, such as riverbanks, railway lines, and suburban areas. Settlements are residential areas that have supporting facilities and infrastructure, while slums experience a decline in quality in terms of physical, economic, and health. Low-income communities often cannot afford to buy or rent decent housing [2]. To address this, the Surabaya City Government is building rental apartments *(rusunawa)* as decent and affordable housing for the poor, especially those affected by eviction.

One area experiencing this problem is Dupak Magersari Village, which is located along the railway line. Residents have lived there for a long time and feel comfortable, despite the dense, noisy, and unsafe environment. They claim to have inherited land certificates, even though the land belongs to PT KAI. Basic infrastructure such as electricity and clean water is available, but the roads are still inadequate. The culture of mutual cooperation in this village is quite strong. Although offered to move to a low-cost apartment, many residents refused because the location of the apartment was too far from their place of work. They also refused compensation because it was considered unsuitable. This issue indicates obstacles in the provision of decent housing by the government. From this condition, several issues arise: (a) how to determine a strategic location for the low-cost apartment so that residents are willing to move, (b) how to provide facilities that meet the needs of residents, and (c) how to design a decent and sustainable low-cost apartment. This design uses a qualitative approach with descriptive analysis methods. Data was collected through observation and interviews with low-cost apartment residents, guards, and managers. After the data is collected, an analysis is carried out to support the design of better housing that is in accordance with community needs.

LITERATURE REVIEW

The theme in this design is "Behavioral Architecture" as follows: (a) architecture comes from the Latin words archi and tecton, which mean "expert builder" [3]. Architecture is a building design made by humans and becomes a place for humans to carry out activities [4]; (b) human behavior is the result of human experience and interaction with the environment, which is manifested in the form of knowledge, attitudes, and actions. Behavior can arise from within a person or due to the influence of the surrounding environment [5]; and (c) behavioral architecture is architecture that discusses the relationship between human behavior and its environment [6]. According to JB Watson (1878-1958), behavioral architects are architects who, in their design process, always include considerations related to behavior [7]. With this approach, we will see how necessary it is to understand human behavior in the use of space and as users of buildings [4].

According to the Regulation of the Minister of Public Works and Public Housing Number 1 of 2021 concerning the criteria for low-income communities and the requirements for ease of construction and acquisition of housing. What is meant by low-income communities (MBR) is a group of people who have limited financial capabilities. Therefore, they require assistance from the government to be able to own a home. [8]. Having an income below the average or below the city's UMR, living in a narrow residential area that does not meet health standards, and generally living in tenement houses or large buildings occupied by several families at once [9].

Based on Law No. 1 of 2011, settlements are part of the living environment outside protected areas, both in urban and rural areas, which serve as residences or dwellings and as locations for activities that support life and livelihood. Meanwhile, slums are residential areas that are unfit for habitation due to irregular building arrangements, high building density, and the condition of buildings, facilities, and infrastructure that do not meet eligibility standards [10].

Rusunawa, according to Permenpera No. 14 of 2007, is a multi-storey building divided into several residential units [11]. The construction of *rusunawa* is prioritized in former slums and is intended for low-income residents who previously lived there [12]. Sustainable housing is housing that is designed to be healthy and decent in the midst of dense cities by utilizing the sun and

rainwater [13]. The implementation of sustainable development planning has three main objectives, namely, economic development that is economically viable, dynamic, and sustainable [14].

According to Widjajanti, green open spaces play a role as part of a harmonious, comfortable, and beautiful urban environment, supporting the lives of urban communities. Thus, green open spaces can function optimally as a means of realizing cleanliness, health, harmony, and beauty of the environment [15].

METHOD

The method used is the design method for design, namely collecting data through observation, questionnaires, or interviews to describe the ongoing situation and analyze existing problems. The data collected is divided into two, namely primary data and secondary data, as follows: (a) *primary data*, data obtained directly from the field or collecting data from the first source. Primary data includes observations of the physical conditions of the location and photo documentation; and (b) *secondary data*, data collected from other sources that are not from the first source as a means of obtaining information. Secondary data includes books, articles, reports, or the internet, as well as the results of comparative studies to other relevant locations. The steps in solving the problem can be explained through a flowchart of the method that has been determined and is shown in Figure 1.

RESULTS AND DISCUSSION

Site Location

This *rusunawa* was built for low-income communities (MBR) and migrants from outside Surabaya, with the main target being the residents of the Dupak Magersari Gang 1 slum. The location of the *rusunawa* site is planned at Jalan Raya Dupak No. 18, Jepara, Bubutan District, Surabaya, near the Surabaya Wholesale Center (PGS), with a land area of 2.3 hectares, which can be seen in Figure 2. This location was chosen because it is strategic and close to the workplace of the majority of residents, especially traders at PGS. In addition, this site is expected to be a more decent and safe housing alternative for residents who previously lived too close to the railway tracks.

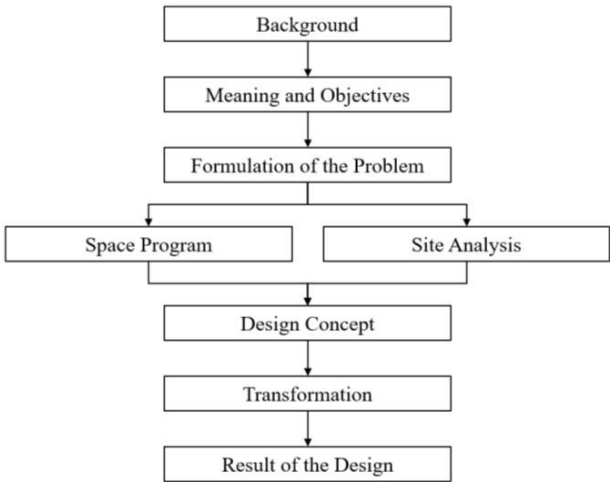


Figure 1. Methodology chart.



Figure 2. Site location.

Data regarding the site:
a. Land area: 23,000 m² (according to Surabaya City RDTR)
b. Including areas with high density levels
c. Maximum KDB (Basic Building Coefficient): 50%
d. Minimum KDH (Green Base Coefficient): 10%
e. Main road width: 8 meters
f. Minimum GSB (Building Boundary Line): 4 meters

The boundaries of the site include:
a. Northern Boundary : Densely populated illegal settlements
b. Southern Border : Shophouse complex and Dupak Highway
c. Western Boundary : Densely populated settlements
d. Eastern Boundary : Pasar Turi Station and Pasar Turi Baru railway tracks

The site selected for the Rental Apartment Design is located in Bubutan District, within the Government Office Sub-Zone (KT-1). This sub-zone encompasses various uses such as apartments, warehouses, hotels, flats, and more. Because flats are permitted within this zone, the site's location complies with the Land Use Map issued by the Surabaya City Public Housing and Settlement Areas and Land Agency and complies with local regulations.

Land Use Design

The layout design of this low-cost apartment uses the concept of "interaction," which not only organizes the building according to its function and zone but also connects all elements so that residents can interact with each other. The land transformation is shown in Figure 3, whose curved shape is divided into three main zones: a public zone, a transition zone, and a private zone. After that, spaces are divided into parks, children's play areas, sports areas, and communal gathering spaces. From this division, interconnected paths are created to facilitate meeting with residents and create a lively social atmosphere.



(a) (b) (c)

Figure 3. Land use transformation.

Figure 3 illustrates the progressive land use transformation in the study area. (a) The south side, near Jalan Raya Dupak, is the main access to the area. This area is equipped with commercial zones such as shophouses/SMEs, a food court, a mosque, a visitor parking area, and signage as a visual marker of the area. (b) The north side borders a dense settlement and is given vegetation as a buffer zone to reduce noise and become a natural boundary. (c) The east side, which borders the train tracks and the new Turi market, is used as a service area, such as the MEP room, IPAL pumps, and IPAL lake. (d) In the center of the area there is a communal plaza with facilities such as a basketball court, soccer field, amphitheater, and green seating area, as a center of community activities that is easily accessible from all directions.

Building Form Design

The form of this *rusunawa* building is designed with the intuitive use concept that is easy to understand and use by all groups. It also incorporates the Vertical Kampung concept that mimics the atmosphere of a village in a vertical residence. The transformation of the form can be seen in Figure 4, which begins with a block shape and is then reduced in several parts to create air circulation, light, and transitional spaces. Numerous parts are also added to increase balconies and the number of units while still maintaining natural lighting and air. The roof is given an additional element as a visual marker and building identity.

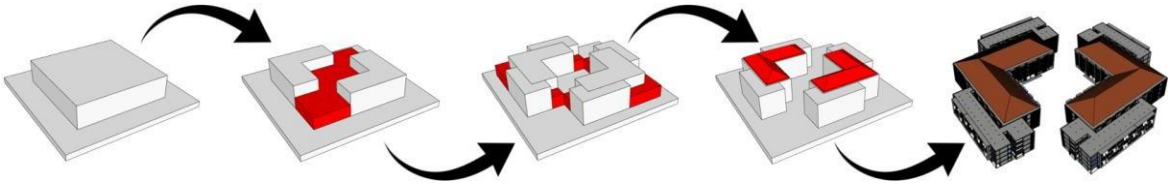


Figure 4. Shape Transformation

In Figures 5 and 6, several sections of the facade and windows use teak wood panels and frames to create a natural, warm feel. Butterfly screens, louvers, and wood panels are installed to keep the air cool and maintain privacy. Canopies and shading elements are also added to reduce solar heat gain.



Figure 5. Building View



Figure 6. Building View

Space Design

The design of this apartment uses the concepts of flexible use and shared space. The flexibility use concept is implemented by creating a main room without permanent partitions, allowing residents to organize the space's functions according to their needs, such as for sleeping, gathering, or small business purposes. The shared space concept is implemented by providing a shared kitchen, laundry room, and drying area for several units. Below is the transformation of the apartment space in Figure 7.



(a) (b) (c)

Figure 7. Building interior evolution: (a) initial empty room structure; (b) installation of sustainable partitions forming circulation paths; (c) final layout with finished functional areas.

The roof is used for technical space and open voids to allow light and air to enter below. There are also four types of rooms: (1) Type 1 (8 × 3 m), on the ground floor, specifically for the elderly, complete with a kitchen, bathroom, and private drying area. (2) Type 2 (6 × 3 m), also on the ground floor, without a kitchen and private drying area, but with shared facilities. (3) Type 3 (8.5 × 3 m), on the upper floor, suitable for small families, complete with private facilities. (4) Type 4 (7.5 × 5 m) has a balcony that can be used for urban farming, such as growing vegetables.

Structural Design and Construction

In Figure 8, the main structure of the building uses a reinforced concrete frame consisting of beams, columns, floor slabs, and footplate foundations and 40 cm diameter bore piles. Columns are 30 cm in diameter with Ø12 mm reinforcement and Ø8 mm stirrups, while beams use Ø10 mm reinforcement and Ø8 mm stirrups spaced 15 cm apart. Sloof binds the columns and distributes the load to the foundation. The floor uses a reinforced concrete slab that is strong enough to withstand the load, while the roof uses a combination of concrete slabs and a light steel frame with glazed tiles as a covering. Ring beams are placed above the columns to bind and support the roof.

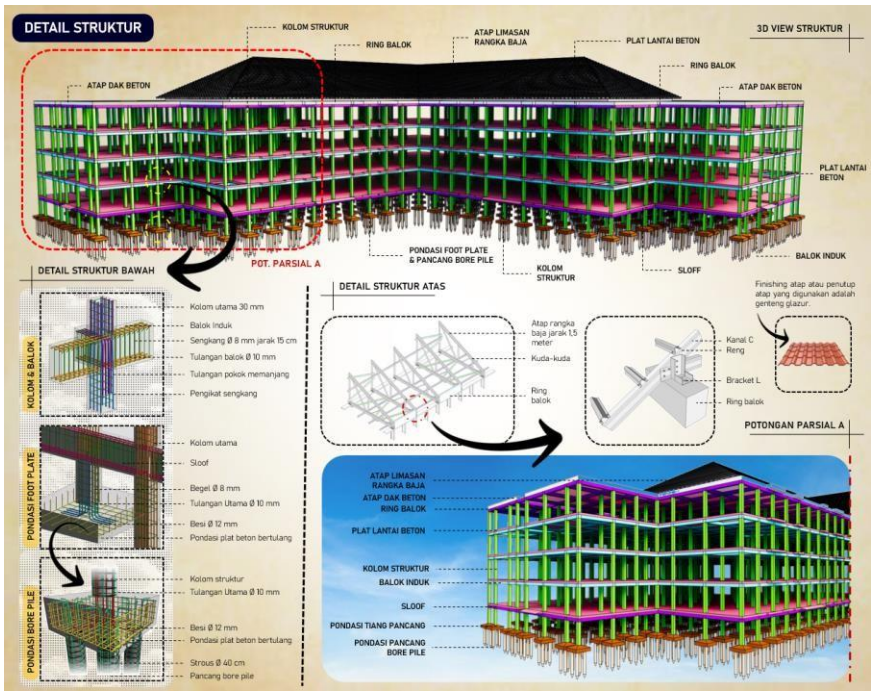


Figure 8. Building structure design & construction.

Architectural Science Design

In Figure 9, this apartment building is designed to allow natural sunlight and fresh air to enter. Windows face east and west, and there is a void above the building for natural lighting. Low-E glass is used to retain heat without blocking light. Sun shading, such as louvers and

canopies, is installed to reduce glare. Natural air circulation (cross ventilation) is created through windows, doors, and air vents (roosters). Shade trees are also planted around the building to add coolness. This design keeps the room bright and cool without relying on electricity.



Figure 9. Building lighting and ventilation design.

CONCLUSION

Based on the data, research, and design process that has been carried out in accordance with the title and objects that are the focus of the design. It can be concluded that this apartment is intended for people who need affordable housing. Especially residents of Dupak Magersari Village. The location is close to the Dupak Magersari Gang I settlement, so the residents are interested in moving to a safer and more suitable place because the previous house was very close to the train tracks. By taking the theme of behavioral architecture, this design is expected to create an environment that supports social interaction. The design is made based on the needs and habits of residents, as well as the principles of behavioral architecture, to create a comfortable residence and support well-being.

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