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GREEN APPROACH IN DESIGNING RUMAH SUSUN SEWA SEDERHANA (FLAT RENT) IN RANCACILI BANDUNG INDONESIA

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Abstract

'Rumah Susun Sewa Sederhana' (Flat Rent) is well known as low-cost housing, generally addressed to accommodate people with low income in Indonesia. This paper intends to express the process of the proposed green approach in designing Flat Rent in Rancacili, Bandung Indonesia. Concerning green building to achieve building sustainability, this is an issue of concern in the built environment and frequently very costly. The explanatory research method was chosen to examine the green theory applied in the green design method that consists of planning and programming, design concept decision, and design process so that many aspects of the design can meet cost reduction. Green architecture minimizes the harmful effects of construction projects on human health and the environment so that the design should be green approached. In addition, it aims to safeguard air, water, and earth by choosing eco-friendly building materials and construction practices besides nonmaterial and construction aspects. The results of this design process showed a design that considers many green concepts from A to Z of the process. The focus on applying the modular system in many design elements, particularly produce zero waste material can reduce the cost. It is expected to achieve an affordable price for middle to low-income people

Keywords: Green approach, Low cost, Modular system, Rental flat, Rumah Susun Sewa Sederhana.

1. Introduction

Developing Flat Rent in Indonesia is a well-known government program since many years ago. The low-cost housing program addressed low-income people. Therefore, affordable prices for middle to lower people are the main consideration. Costs that will be charged to the tenants are the costs of facility operations such as electricity, water, repairs, and maintenance. It is considered a good idea for the design process, as part of the cradle to grave design, which had thought how the construction and operation of facilities to be throughout the design process to minimize mistake [1].

Nowadays, the environment in common is closely related to sustainable development. It should be environmentally friendly to reduce environmental pollution, simultaneously reduce costs, and increase revenue [2]. It affects the costs of renting and operation of facilities.

Flat is residential units that are used separately. The tenure status is rental, and the main function is residential. Flat was built by the government using State or Regional Budget funds. Usually, the local government cooperates with the Ministry of Public Housing. The development of Flat aims to provide a decent home for all Indonesian families, especially the Low-Income Community (MBR) in Indonesia who are not able to meet their housing needs through ownership [3].

Nowadays, every government and private institution is trying to operate at the lowest possible cost and environmentally friendly. One of the efforts made is by designing energy-efficient buildings [4].

This proposed design process shows how the green approach has been written, discussed, and understood as energy efficient. It is also based on Munashinge statement in MCG vision for 2030 is [5]:

- Environmentally, to reduce the footprint of global human resource use within the boundaries of the planet's sustainability.
- Socially, to meet the basic needs of the poor and make consumption distribution more evenly distributed.
- Economically, to promote prosperity in an efficient sustainable economy, but respect critical environmental and social sustainability constraints.

In this context, it needs more attention the integration of the three aspects, which are social, economic, and environmental aspects. The green concept from A to Z includes strict application of Floor Area Ratio (FAR), Building Coverage Ratio (BCR), Green Area Coefficient or *Koefisien Daerah Hijau* (KDH), and Communal Space as the site concern. Other than that, modular system usage on some building elements to eliminate material waste thus create environmentally safe and secure aspects. One of the biggest concerns when it comes to tenant life is the security of the apartment. Feeling safe in your home is important. Therefore, the right steps had to be taken in choosing a safe and secure apartment [6].

This study aims to inspire similar facility designs through this research's design approach. Although Indonesia has not officially implemented the green requirements on the building designs, the Indonesian government has implemented the green approach on a broader scale in the design of flat buildings.

2. Method

The explanatory research method was applied to this study. The research design focuses on explaining aspects of the research in detail [7]. The results of applying the green concepts in building design particularly in Indonesia were not well researched before.

The design method conveys the detailed process consists of some phases including planning and programming, concept solving, and the design as a result. The method internalized the green concepts. Planning and programming phase embrace data collection, data analysis, as well as data synthesis including revealing some design concepts. Design concepts resolve is the next step. The design concepts could be both written and graphical. The last step is the design process that embraces the theme and design concepts throughout the process (show in Table 1) [1].

Table 1. Diagram of the design method.

Design Methods	
No.	Problem Seeking (Step One) Planning And Programming (Considered Saving Time and Cost)
1	Data collection, green concern at the most
2	Analysis
3	Synthesis
	Design concepts
	Design

3. Results and Discussion

A true work of architecture expresses a single theme that integrates all aspects of work into a coherent whole. Everything comes from this focus and expresses it. Without this thematic integrity, work is just a collection of parts that have no power. In other words, harmony in architecture should have four characteristics: pleasant, consistent with the theme, united, and diverse [7]. The theme of this design is Green Architecture; therefore, most design concepts emanate from the theme to solve the problems and develop the potencies. The following is the green design criterion for design and building elements [8].

3.1. Site concern

The allocation site is determined based on the integration between the transportation/ circulation systems and land use. In addition, it also determines the slope carefully in the context of contour and minimizes cut as well as fill volumes. It also considers the Floor Area Ratio (FAR), Building Coverage Ratio (BCR), and Green Area Coefficient (KDH). The circulation system designed adjusts and follows the land use represented by the red line that marks the vehicle circulation, green lane marks pedestrians' paths, yellow lane marks drop off, and orange lane marks garbage as shown in Fig. 1.

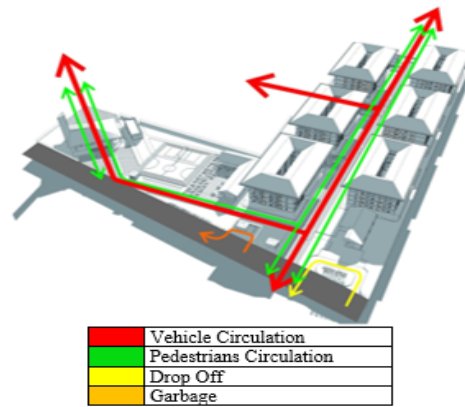


Fig. 1. The integration between the circulation system and land use; Communal space creates comfortable thermal conditions on pedestrians' paths.

3.2. Green open space and communal space

The design should be configured by means of multi-purpose pedestrian scale distances. Create comfortable thermal conditions on pedestrians' paths and outdoor communal spaces by applying layers of cooling such as outdoor open spaces, landscaping, pools of water, etc. [8]. Communal space is a multi-function space used to accommodate joint activities by a group of people or a particular community in a community or region. In terms of communal life, communal is defined as an activity of sharing ways of life that are carried out by a group of people voluntarily, with the belief that it would be better if they lived together rather than individually. In a community context, groups are more important than individual interests [9].

Vegetation and landscaping designs were used to space cooling or outdoor air conditioning. Using sunlight for most of the lighting as well as for solar heating can reduce artificial lighting, using wind for natural ventilation and generators, using water and rainwater as a medium of internal and external air conditioning as well. The calculation of the Green Area Coefficient (KDH) is strictly carried out. Comfortable thermal conditions on pedestrians' paths and outdoor communal spaces are created by applying layers of cooling such as outdoor open spaces, landscaping, pools of water, etc. (shown in Fig. 2).

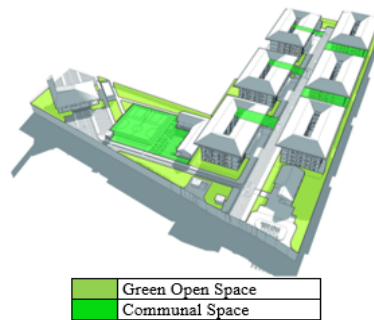


Fig. 2. The integration between the circulation system and land use; communal space creates comfortable thermal conditions on pedestrians' paths.

3.3. Modular system

To minimize waste materials, the concept of a modular system was adopted in this study. The system derived from the Modular, an anthropometric scale of proportions, introduced by the Swiss-born French architect Le Corbusier (1887-1965). Le Corbusier, one of the prominent people in the Architecture Modern-Era developed a visual bridge between two incompatible scales, the imperial and the metric system. It is based on the height of a man with his arm raised. In this study, the modular system is more concerned with fitting various materials sizes. It is an effort to achieve fitted conditions between various superimposed elements that have measurement either multiplication or division of 1.2 m, among them structural system, floor system, ceiling system, and wall system.

Floor systems, ceiling systems, and wall systems use materials, which have multiplication or division of measure 1.2 m. Through considerable designs, forms fitted design and leave zero waste materials. For example, the structural system has a span of 6 m, so that the ceiling made of gypsum measuring 1.2 x 2.4 only needed 7 sheets of 1.2 x 2.4 and 1 sheet of 1.2 x 1.2 (half of the gypsum), which the other half can be used in the next unit. This is similarly applied to other systems as shown in Fig. 3.

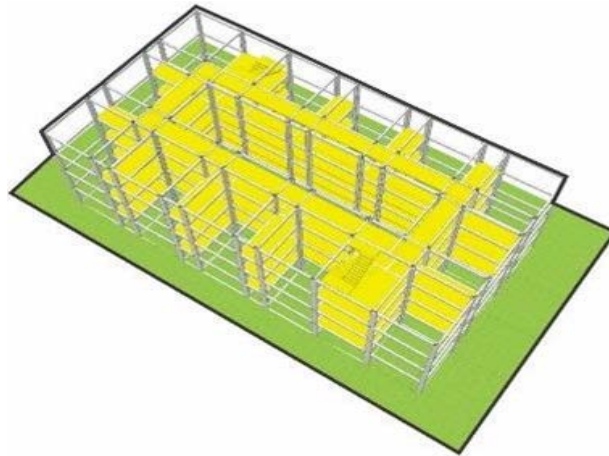


Fig .3. Modular system on a structural rigid frame system. The system is based on measurement unit 1.2 m; The span of the structure is 6.0×6.0 m.

3.4. Safety and security

Socially, sustainable development as the main wave of green design should provide material well-being including education, good health, access to goods and services necessary for a decent life. Other than that, the design must appeal to the achievement of social, cultural, and political, such as a sense of dignity, security, and the ability to become part of the community through recognition and representation [10]. The safety and security concept in this study applied to various design elements, but primarily applied to structural rigid frame system by installing the bracing system, to anticipate lateral earthquake loads. Fire safety applies to fire escape design, the material used, and access for firefighters as shown in Fig. 4).

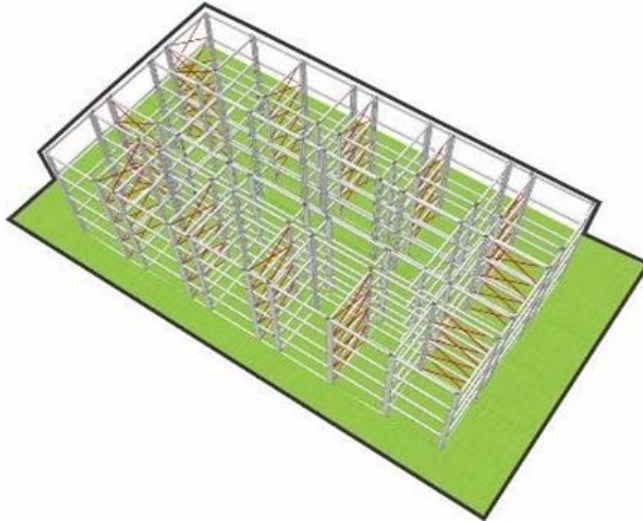


Fig. 4. Rigid frame structural system. Bracing is applied to the structure to enforce the structure to be more safe and secure

3.5. Design

Not every green concept could be applied in a design, but maximizing the green concept is very important. Fortunately, the Bandung city government has paid attention to green criteria, i.e., *Rusunawa* should accommodate residents who have jobs close to *Rusunawa*, has a facility for high interaction residents, apply natural ventilation, and has low rent. The following design shows the result that the design process holds optimizing green concepts.

3.5.1. Site plan

Building Coverage Ratio (BCR), 50% of the total land area of 24000 m² receives 12000 m² ground floor areas of the entire buildings. Floor Area Ratio (FAR) 1.2 got 28,800 m² overall floor areas that can be built. Green Open Space and Communal Space have a total area of 12,000 m² originating from Green Area Coefficient (KDH) 50% [11], which could enhance outdoor cool temperatures (shown in Fig. 5).

3.5.2. Rusunawa building

Rusunawa Rancacili buildings consist of four typical units, young family unit, single unit, family unit, and elderly unit. Most of the units occupy one structural module unit of 6 m x 6 m, but for several units that need more spaces than 36 m² the additional spaces will be multiplication or division of 1.2 m. Each unit is being in a reinforced rigid frame structural space. Natural lighting and natural ventilation apply to all units; so that each unit has a direct connection to nature. The units are placed in peripheral buildings to get natural lighting and ventilation so that minimize artificial lighting and ventilation as shown in Fig. 6.



Fig. 5. Site plan *rusunawa* rancacili.



Fig. 6. Young family unit.

Figure 7 shows an example of one family unit. The unit consists of one main bedroom, one living room, one dining room, one kitchen, one bathroom, and a balcony, which is also intended for a sunroom (shown in Fig. 7).

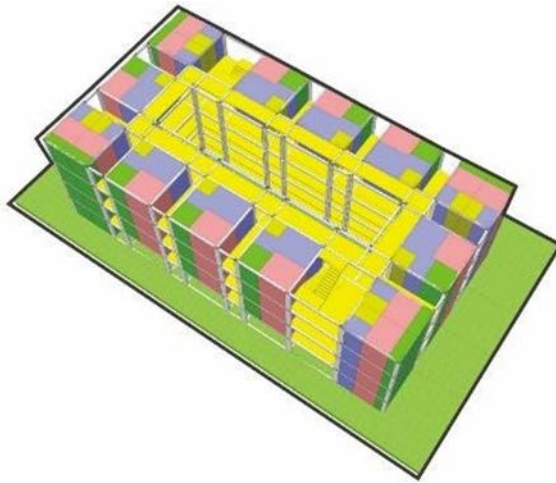


Fig. 7. Rusunawa rancacili building, each building consists of various units.

Figure 8 shows the composition of various units in a *Rusunawa Rancacili* building. Each unit occupies one 6 m X 6 m structural module and is placed on periphery building to get natural lighting and ventilating (shown in Fig. 8).



Fig. 8. Outdoor performance of proposed design rusunawa rancacili Bandung.

4. Conclusion

There are many green concepts applied in a design, not all of them can be applied at once but maximizing it is important. Through the explanatory research method, this paper describes a design process that adopts a green approach along with a green concept internalized in the design method. The design method consists of

planning and programming, conceptual decisions, and the design itself as a result. The modular system, which is derived from the Le Corbusier Modular is applied to the dimensional aspect of various elements or components, such as structural, floor, ceiling, wall system, and others. The accumulation of these various elements on the unit dimension suitability, both multiplying and dividing the unit dimension, considered reducing or even eliminate waste materials. The green concept is also applied to various design elements such as green open spaces and communal spaces, as well as safety and security aspects.

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