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ANALYSIS THE APPLICATION OF GREEN BUILDING PRINCIPLES IN CITRALAND GAMA CITY HOUSING BASED ON THE GREENSHIP HOMES RATING SYSTEM VERSION 1.0

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ABSTRACT

Now this housing development is still a lot of housing without thinking about the concept of green. This results in one of the causes of global warming that can damage the environment. Indonesia also has a rating system known as Greenship compiled by the Green Building Council Indonesia (GBCI). For the above reasons, this study aims to analyze the principle of green building in housing Citraland Gama City type Avellino using benchmark Greenship Homes V 1.0. This research is located at Jalan Ismail Harun, Percut Sei Tuan District, Deli Serdang regency, North Sumatra. CitraLand Gama Medan City. The research methodology used is a qualitative method, variables used using Greenship Rating Tools for residential version 1.0. Data collection methods using primary and secondary data, data collection techniques using observation, interviews and documentation. From the analysis and discussion it can be concluded that the type of building Citraland Gama City- Avellino only able to meet the average value of 54.2%. related to the application of environmentally friendly building principles from the total benchmarks contained in Greenship based on four categories consisting of Land Use 66.6%, Energy Efficiency and conservation 41.1%, Water Conservation 46.1%, and Health and comfort in space 64.3%.

KEYWORDS: Green Building, Greenship Home, Environmentally Friendly.

1. INTRODUCTION

Population growth and the increase in housing needs is an impact that will always follow the development of the city, however, as a natural component that is limited, urban land at a certain point will no longer be able to accommodate the burden of housing needs [10]. This has led to high demand for housing and supporting infrastructure. As a result, housing development in large cities often extends to the suburbs/border areas of the city.

An unfavourable indoor environment can affect the comfort and health of the occupants of the building and can affect the ability to work [4]. During the Covid 19 pandemic most people have spent 90% of their lives indoors and people who work indoors are at greater risk of exposure to the Covid 19 virus. According To [6] viruses spread by infected people have the greatest risk in the process of transmitting the virus indoors. For people with weakened immune immunity, the risk is greater if they have close contact with an infected person, especially without adequate measures of respiratory protective equipment.

This study discusses the Green Building or green building that combines the concept of good land layout, efficient electrical energy, efficient use of water, comfortable room conditions, environmentally friendly building materials, as well as building Environmental Management in building and operating a green building. Buildings that apply the principles of sustainability since the planning, design, construction and operation of buildings, known as Green Buildings (Green Building).

A building is said to have a green building concept when it meets the Green Building criteria. These Green Building criteria are based on an assessment benchmark known as a rating system. The rating system is compiled by the Green Building Council of each country that has followed the Green Building Movement, for example USA with LEED Rating, Malaysia with Green Building Index, Singapore with GreenMark, Abu Dhabi with Estidama and Australia with Green Star. The categories in each rating system in various countries are adjusted to the social, economic, and environmental conditions in each country [2].

Indonesia also has a rating system known as GREENSHIP compiled by the Green Building Council Indonesia (GBCI) as a benchmark that is easily understood by the public about how the implementation of green building for its occupancy by involving professional stakeholders, industry, government, academia, and other organizations in Indonesia. GBCI itself was founded in 2009 by professionals in the design and construction sector of buildings that have a concern for the implementation of the concept of green buildings.

Greenship is an assessment system that is useful as a tool in order to implement best practices and strive to achieve measurable standards that can be understood by the general public and building users. There are five types of certification depending on the scope of the area , which include new buildings, existing buildings, Interior spaces, areas and houses.

In this study focused on greenship assessment for residential homes, the assessment system is divided by six categories, namely appropriate Site Development, energy efficiency and Conservation, Water Conservation, material Resource and Cycle, Indoor Health and Comfort, Building Environment Management. These six categories can be a determining parameter for the successful implementation of environmentally friendly practices. Each criterion consists of several benchmarks and each

benchmark has different values according to the level of difficulty. From several benchmark values that have been totalled, the overall value of the percentage of housing will be obtained. Each percentage will get four greenhip ranking criteria, namely Platinum, Gold, Silver and Bronze [5].

This research is located at Jalan Ismail Harun, Percut Sei Tuan District, Deli Serdang regency, North Sumatra. CitraLand Gama City Medan is a property development project from Ciputra Group in collaboration with GamaLand in Medan City. Developed on an area of 211.57 hectares and built with six housing clusters.

The purpose of this study was to analyze the aspects of green building has been applied to the building CitraLand Gama City based on variable GBC Indonesia greenhip home version 1.0. Thus, it can be seen what is the main consideration of the developer in the design of the Citraland Gama City Building, especially its influence on the sustainability aspects of the building. Based on the description above, the authors need to conduct a research study with the title thesis is a study of the application of green building principles in housing Citraland Gama City based on the Rating system Greenhip Homes Version 1.0.

2. LITERATURE REVIEW

2.1 Green Building

Green Building is a building concept designed to reduce the impact on the environment. By applying the concept of green building to buildings, it is expected to reduce the use of Energy, Natural Resources, and the impact of pollution from buildings. The biggest points in the application of this green building concept are water and energy savings, as well as the use of renewable energy to protect the environment from increasingly severe damage, and reduce the formation of construction waste. (Kevin.G, et.al. 2016). Basically, the construction of the building starts from the selection of land, if it is built on green land, the habitat of plants and animals that previously lived on the land will slowly be threatened and then look for new habitats or even destroyed. Entering the construction phase, the construction will use materials and a relatively large amount of energy as well as electrical and water energy needs, although not as much as when the building was in operation. At the stage of operation and maintenance of the building, the problems posed are energy consumption, consumption of Natural Resources and the presence of waste produced both solid and liquid waste [8].

According To [1] the goal of Green Building practices is to manage the construction of buildings and infrastructure and care for existing resources, reduce negative impacts on the environment, and produce an environment that provides developed standards for the residents who live there.

2.2 Green Building Council Indonesia

Green Building Council Indonesia is an independent non-profit organization established in 2009 by leading professionals and companies in the building industry in Indonesia. GBC Indonesia has a main program of training and education as well as Green Building Certification [5].

2.2.1 Green Building Certification

Green Building Council Indonesia as a prime mover to encourage the growth of green building Indonesia, has undergone a certification program since 2009. Currently, GBC Indonesia runs two different certification systems. Greenship certification is based on the Greenship rating tool developed by GBC Indonesia and currently includes six types of certifications such as New Building, Existing Building, Interior Space, Homes, Neighborhood, and Net Zero Healthy.

2.2.2 Training and education, GBC Indonesia has four training namely:

- Greenship Associate Training (GA)
- Greenship Professional Training (GP)
- EDGE Expert
- EDGE auditors

2.3. Greenship

Greenship is an assessment system used by GBC Indonesia as a tool for building industry players, both entrepreneurs, architects, electrical mechanical technicians, interior Design, building technicians, landscape architects, and other actors in order to implement best practices and strive to achieve measurable standards and can be understood by the general public and building users [9].

There are six categories in the Greenship benchmark, Appropriate Site Development (ASD), Energy Efficiency and Conservation (EEC), Water Conservation (WAC), Material Resource And Cycle (MRC), Indoor Health and Comfort (IHC) and Building Environmental Management (Bem). Greenship is intended for buildings that meet the eligibility according to their classification, which are distinguished as follows:

- For new buildings used Greenship New Building version 1.2
- Untuk gedung terbaru digunakan Greenship Existing Building versi 1.1
- For residential homes used Greenship Home version 1.0
- For deep space used Greenship Interior Space version 1.0
- For regions used Greenship Neighbourhood version 1.0

2.4 Greenship Homes

Greenship Homes is one of the benchmarks issued by GBC Indonesia used as a tool in order to implement best practices and strive to achieve measurable standards and can be understood by the general public and building users. There are several categories in evaluating housing that deserves to be a greenship home, namely land use, energy conservation & efficiency, water conservation, material resources & cycles, Health & Comfort in Space, building Environmental Management [5].

2.4.1 Appropriate Site Development

Land use also affects, so land should be used as optimally as possible. The placement of housing locations must also be strategic and pay attention to several things such as green areas, supporting

infrastructure, Community Accessibility, Pest Control, Public Transportation and handling of rainwater runoff.

2.4.2 Energy Efficiency and conservation

Housing with a green building concept is designed to save energy because energy is increasingly scarce. For energy savings should pay attention to such points as Sub meter, artificial lighting, air conditioning, heat reduction, energy-saving household appliances and renewable energy sources.

2.4.3 Water Conservation

With the concept of green home can be done pengolahan dirty water to be used as irrigation so that the use of clean water can be reduced. The use of clean water can be as efficient as possible by paying attention to several things including water meters, water-saving output devices, rainwater use, water-saving irrigation and Wastewater Management.

2.4.4 Material Resource and Cycle

The use of materials and the selection of each particle of material has a significant impact on the environment. Therefore, in the use of materials, attention should be paid to things such as non-ozone-depleting refrigerants, the use of used materials, materials from environmentally friendly sources, materials with environmentally friendly production processes, certified wood, prefabricated materials, local materials and waste sorting.

2.4.5 Indoor Health and Comfort

The quality of the environment in the room includes indoor air circulation, lighting, air temperature, pollution level. To improve health and comfort should pay attention to such things as clean air circulation, maximizing natural lighting, Visual comfort, minimization of sources of pollutants, spatial comfort and acoustic level.

2.4.6 Building Environment Management

To improve the environmental management of buildings must pay attention to things such as sustainable design and construction, home building guidelines, environmentally friendly activities, Waste Management, Security, Innovation and Home Design grow

From several benchmark values that have been totaled, the overall value of the percentage of housing will be obtained. Each percentage of housing will be obtained 4 criteria, namely Platinum for the number of assessments above 73%, Gold for the number of assessments 57-72%, Silver for the number of assessments 45-56%, Bronze for the number of assessments 35-44% [5].

3. METHODOLOGY

3.1. Research Areas

Geographically, the study area is located at $3^{\circ} 54' - 3^{\circ} 83'$ north latitude and $98^{\circ} 72' - 98^{\circ} 86'$ east longitude. CitraLand Bagya City is a housing estate with a private developer with an area of 211.5 hectares (figure 3.1). Located at Jalan Boulevard Raya, Kenangan Baru, Percut Sei Tuan District, Deli Serdang, North Sumatra.

Based on the results of the literature review, to be able to analyze the application of green building principles required a benchmark that includes all the variables. In this study, the authors used a benchmark from GBC Indonesia, namely GreenShip Rating Tools for residential version 1.0. Selection of GreenShip Rating Tools as a benchmark in this study because it already has a category that matches the criteria of green buildings. Variables GreenShip Rating Tools for residential version 1.0 that will be analyzed are appropriate Site Development, Energy Efficiency and Conservation, Water Conservation and Indoor Health and Comfort,

In sampling the research site, using non-probability sampling techniques while determining the sample determination using purposive sampling. Purposive sampling is a sampling technique based on the researcher's consideration of which samples are most appropriate, useful and considered representative of a population (representative). The location taken is Citraland Gama City Housing, a Pasadena – type Avellino Cluster.



Figure 3.1: Map of The Research Site Source: Developer Citraland Bagya City

The research methodology used is a qualitative method, variables used to use GreenShip Rating Tools for residential version 1.0. Data collection methods using primary and secondary data, data collection techniques using observation, interviews and documentation.

4. RESULTS AND DISCUSSION

As explained in sub chapter 1.1, the background of this study is to analyze the application of green building principles in Citralan Gama City Housing. Evaluation is done by comparing the benchmarks

contained in the greenship home with the data owned. The categories to be analyzed include the appropriate category of land use, energy efficiency and conservation, water efficiency, and health and comfort of space.



Figure 4.1 view and Cluster plan Pasadena-Avellino Citraland Gama City Source: <https://citralandgamacity.com/>

4.1 Analysis of Appropriate Site Development Categories

4.1.1 Land Suitability

Citraland Gama City Building is located at Jalan Boulevard Raya, Kec. Percut Sei Tuan, Medan City. Based on The Deli Serdang regency regional Regulation Number 1 of 2021 concerning the Deli Serdang regency Spatial Plan for 2021-2024, it is explained in Article 9 paragraph 3 letter e, that Percut Sei Tuan serves as a housing and settlement center, regional trade and services, agriculture and fisheries, industry, Center for Education, Health, Sports, forestry activities, and tourism.



Figure 4.2 Spatial Pattern Map of Deli Serdang Regency Source: jdih.deliserdangkab.go.id

Based on the spatial pattern of Deli Serdang regency, Percut Sei Tuan district contained in Figure 4.2 above, the location of the site marked with a red circle, indicating that the site is located in a residential designation area.

4.1.2 Green Base Area

As based on the regional regulation of Deli Serdang regency No. 6 of 2011 on certain permits described in Article 24 paragraph 3 and regulation of the minister of Public Works No. 29 of 2006 on technical guidelines for building, it is explained that the land use permit contains one of the minimum green base coefficients which is required to be 10%. Meanwhile, in the Avellino type Citraland Gamacity building, the open area used for planting is 27 m² of the total land area of 120 m², so that the percentage obtained is ± 22.5 %.

Table 4.1 Percentage of Green Base Area

No	Luasan	Luas m ²	Persentase
1	Luas Area Dasar Hijau	27	22.5
2	Luas Lantai Dasar	48	40
3	Luas Perkerasan	45	37.5
Luas Total Site		120m ²	100%



Figure 4.3 Green Base Area of Citraland Gama City Housing-Avellino Type Source: Personal Sports, 2023

The selected plants as seen above are tabebuaya trees and candle FIRs. The housing uses 100% plants derived from local nurseries taken in the Mardisan Flower Garden and surrounding areas with a distance of 14.2 km. shown in Figure 4.4

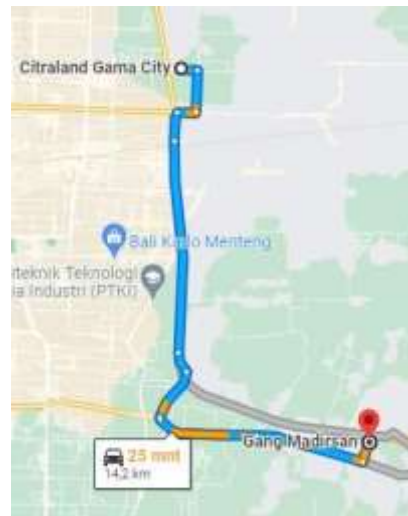


Figure 4.4 location of local nursery, Mardisan Flower Garden Source: Personal Sports, 2023

Thus, the benchmarks that get points are the use of 100% plants from local nurseries with a maximum distance of 500 km and the planting of protective trees in the yard of the house more than the minimum standard.

4.1.3 Supporting Infrastructure

Based on the results of the analysis above, it is known that in terms of supporting infrastructure, the Avellino type Citraland Gama City Building has met the existing benchmarks consisting of a minimum of 5 and a maximum of 8 of infrastructure and utilities, namely road networks, drainage networks, pedestrian area networks, Clean Water Network bicycle paths, artificial lakes, Electricity Networks, public street lighting (PJU), telephone networks and Integrated Waste Disposal Systems.

4.1.4 Community Accessibility

Based on the analysis of the Community Accessibility category, there are 11 facilities located at a distance of 1.5 km or less, namely restaurants, places of worship, sports fields, pharmacies, ATMs, photocopiers, libraries, toll roads, bus stops, bicycle paths, pedestrian paths and Health Centers.

4.1.5 Pest Control

Pest problems in a dwelling, can be a serious problem because it affects the health and comfort of residents. In Greenship Homes, this pest control criterion consists of 5 benchmarks, namely (1). The existence of home design efforts for Mosquito Control, (2). There are design efforts to counter mice. (3). The existence of home design efforts for fly control, (4). The existence of design efforts for cockroach control, (5). There are management efforts to counter termites. Meanwhile, in citraland housing, there are no special design efforts related to pest control.

4.1.6 Public Transportation

For access to Jalan Ismail Harun which is a local road traversed by various public transportation, can be reached with the nearest distance as far as 200 m. So that in this category the building meets the benchmark in terms of access to public transport routes.



Figure 4.5 access to public transport routes Source: Personal Sports, 2023

4.1.6 Handling of Rainwater Runoff

In the handling of rainwater runoff, there are two benchmarks, namely the handling of rainwater runoff for the roof and the handling of rainwater runoff for the yard. As for the Avellino type, it does not have rainwater runoff handling and the provision of gutters for the roof area. While the handling of rainwater runoff for the yard is already available in the backyard, seen in Figure 5.7. Thus, in accordance with the benchmark on the criteria for handling rainwater runoff.



Figure 4.6 the handling of rainwater runoff for the backyard Source: Personal Sports, 2023

4.2. Energy efficiency and Conservation category analysis

4.2.1 Electricity Meter

The benchmark in this category of electricity meters is to provide electricity meters both from grid electricity and self-help electricity. In housing Citraland Gama City uses electricity meters from PLN officially with 2200 VA power. The type of electricity meter used is the prepaid system or electricity token, the electricity meter is useful for measuring the amount of electrical energy used by residents of the House. Electricity meters or kWh meters will be a source of information for residents and officers about the amount of electric power used every day. It looks like figure 5.8



Figure 4.7 Electricity Meter
Source: Personal Sports, 2023

4.2.2 Sub Meter

In the category of electricity sub-meters, the benchmark that needs to be considered is to provide electricity sub-metering of one of the components: lights or air conditioners or contact boxes and carry out the calculation of electricity consumption at home (kwh/m²). The sub electricity meter is installed in the building that is analyzed and serves to measure electricity consumption in each house.

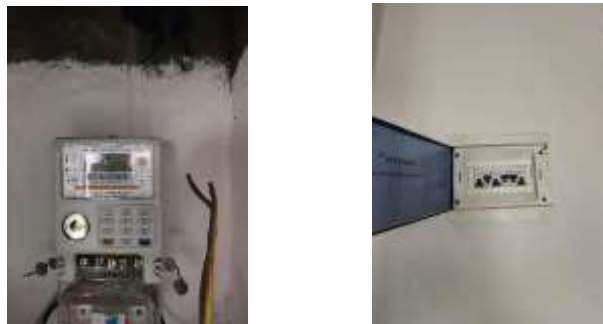


Figure 4.8 Sub Electricity Meter
Source: Personal Sports, 2023

Calculation of electricity consumption at home, the electricity used in the house is analyzed only the lights in each room and effective use from night to morning with a duration of use of 12 hours. For electricity groups 1,300 VA-2,200 VA and above, a tariff of Rp 1,444 per kWh is charged. From this calculation, it is known that the electricity consumption for 20 12 watt led lamps with a duration of 12 hours of use reaches Rp. 112,632 per month. Thus, making it fit the benchmark on the Sub meter criteria.

4.2.3. Air Conditioning

In the analysis carried out, to determine the ability of a house to provide thermal comfort for its residents, it is necessary to conduct a survey when the building is inhabited. The factors that can affect the thermal comfort of a space that refers to 1. Minimum ventilation area 5-10% of floor area, 2. >75% of the total area of regular rooms designed with cross ventilation or 50% of the total area of regular rooms designed with cross ventilation or for homes with poor outside air conditions make efforts to maintain air quality in the House, 3. Have air circulation for the entire bathroom, 4. Have air circulation out of the kitchen.

Calculation of the minimum ventilation area of 5-10% of the floor area of yaiyu as follows:

Formula: total ventilation area / floor area x 100%

- $12,875 \text{ m}^2 / 95 \text{ m}^2 \times 100\% = 13.55\%$

The next benchmark has air circulation for the entire bathroom, there are two bathrooms in the Avellino type building, one bathroom is located on the first floor adjacent to the bedroom and dining room. For the second bathroom is on the 2nd floor adjacent to the master bedroom and children's bedroom. Shown in Figure 4.9.



Figure 4.9 Bathroom Ventilation

Source: Personal Sports, 2023

The next benchmark has the air circulation out of the kitchen. In the kitchen area there is a window measuring 60 x 130 cm and a three-leaf rear door measuring 220 x 250 cm. The existence of circulation and ventilation is very important in the kitchen space because the kitchen requires an exhaust path for smoke during the process of cooking food, also so that the smell of cooking does not pollute other rooms in the House. Shown in Figure 4.11



Figure 4.10 windows and back doors for air circulation out of the kitchen
Source: Personal Sports, 2023

4.2.4. Heat Reduction

In analyzing this building, efforts are made to reduce the heat on the entire roof is done by using aluminum foil. Aluminum foil is a dense and thin aluminum metal sheet that serves as a heat barrier. Thus, the results of the analysis have met these benchmarks because of the design efforts or the use of building materials, which can reduce heat throughout the roof by using aluminum foil.

As for the materials used to reduce the heat that enters through the roof, walls and floors, it is not specifically designed to use special materials as an effort to reduce heat. It's just that for the material on the wall, floor, and roof area used red brick walls, granite floors 60x60cm, and roof coverings using bitumen roof so that the results of the analysis have met the benchmark of design efforts or the use of building materials that can reduce heat on all walls and floors.

4.2.5 Energy-Saving Household Devices

For the criteria for the use of energy-efficient household appliances, there is one benchmark, namely using electrical appliances in homes that are labeled as minimum energy efficient as 50-75% of the total power (watts) of electrical appliances. Appliances that use energy-saving only led lamps. Led lights do not give off heat so it does not increase the room temperature, besides that led lights can save watts of electricity compared to ordinary light bulbs. Thus, it does not fit into the benchmarks on the criteria of energy-saving household devices.

4.2.6 Renewable Energy Sources

In analyzing this building, there is no planning related to the use of alternative energy to meet the needs of existing electrical energy and overall electrical energy comes from PLN.

4.3. Water Conservation Category Analysis

4.3.1 Water Meter

In the building analyzed cannot be allowed to see the water meter register numbers so it cannot do the calculation of water consumption at home (liters/day).



Figure 4.11 Citraland Gama City Building Water Meter
Source: Private Sports, 2023

4.3.2 Water Saving Fixturer

In the criteria for water-saving output equipment, it is necessary to calculate the type of fixture to be used which includes WC/Closet, water tap and Shower based on the survey conducted. The type of fixture used can be seen in Figure 4.13 below:



 Kloos  Keran  Keran  Shower

Figure 4.12 Water-Saving Output Device
Source: Private Sports, 2023

Table 4.2 score Table Water Fixture

WC	Skor
6L/flush untuk seluruh WC	1
4.5L/Flush dan/atau <i>dual flush</i> untuk 50% total WC	2
4.5L/Flush dan/atau <i>dual flush</i> untuk seluruh WC	3
Shower	Skor
9L/menit untuk 50% total <i>shower</i>	1
9L/menit untuk seluruh <i>shower</i>	2
Faucet	Skor
7L/menit untuk 50% total keran	1
9L/menit untuk seluruh keran	2

Thus, the total score obtained is 6, where in the tap fixture only 50% meet the benchmark. These water supplies include bidet, sink faucet, wall and shower faucet,

4.3.3. Waste Water Management

As for analyzing the building, found the use of grease trap in the kitchen area. Meanwhile, the septic tank used in this building is not known to have a filter or media that can process wastewater to be safe for the environment. Septic tank is located in front of the green area of the building. So that in this criterion, a value of 2 is obtained, because it has met the benchmark in wastewater management criteria.

4.4. Analysis of the category of Health and comfort of space

4.4.1. Non-Asbestos

In the non-asbestos criteria there is 1 benchmark, which does not use asbestos material in all parts of the House. The materials in Citraland Gama City buildings are mostly non-Asbestos. The ceiling using gypsumboard, seen in Figure 4.14.



Figure 4.13 ceiling wearing gypsumboard

Source: Private Sports, 2023

4.4.1. Clean air circulation

The criterion for air circulation in space has 4 benchmarks. One of them is that the minimum ventilation area is 5-10% of the total floor area. As for analyzing it is done by doing calculations like this dibawah: The calculation of the minimum ventilation area of 5-10% of the floor area is as follows:

Formula: total ventilation area / floor area x 100%

- $12,875 \text{ m}^2 / 95 \text{ m}^2 \times 100\% = 13.55\%$

In each area of the bathroom there is an opening that is Boven light, allowing air circulation in the bathroom. There are two bathrooms in the Avellino type building, one bathroom is located on the first floor adjacent to the bedroom and dining room. For the second bathroom is on the 2nd floor adjacent to the master bedroom and children's bedroom. Shown in Figure 4.15.



Figure 4.14-bathroom Area has boven light

Source: Private Sports, 2023

The next benchmark has the air circulation out of the kitchen. In the kitchen area there is a window measuring 60 x 130 cm and a three-leaf rear door measuring 220 x 250 cm. The existence of circulation and ventilation is very important in the kitchen space because the kitchen requires an exhaust path for smoke during the process of cooking food, also so that the smell of cooking does not pollute other rooms in the House. Shown in Figure 4.16



Figure 4.15 windows and back doors for air circulation out of the kitchen

Source: Private Sports, 2023

4.4.2 Natural Lighting

The criteria for natural lighting circulation have 1 benchmark, namely, natural light can illuminate at least 50% of the area of the house, according to the 300-lux standard. As for analyzing it is done by doing calculations like below:

Formula: $\text{area of the object} / \text{area of The Room} \times 100\%$

- Living room and kitchen: $18.9 / 27.3 \times 100\% = 69.2 \%$
- Bedroom 1: $5.6 / 8.1 \times 100 \% = 70 \%$
- Bedroom 2: $5.8 / 8.1 \times 100 \% = 71.6 \%$
- Bedroom 3: $9.58 / 18 \times 100 \% = 54.4 \%$
- Bathroom 1st floor: $0,22 / 3.36 \times 100 \% = 6,6 \%$
- Bathroom 2nd Floor: $1.87 / 3.17 \times 100 \% = 58.9 \%$

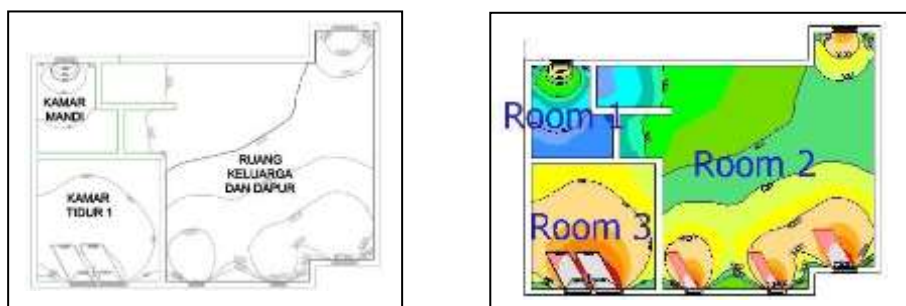


Figure 4.16 Analysis of Natural Lighting Floor 1 Source: Private Sports, 2023

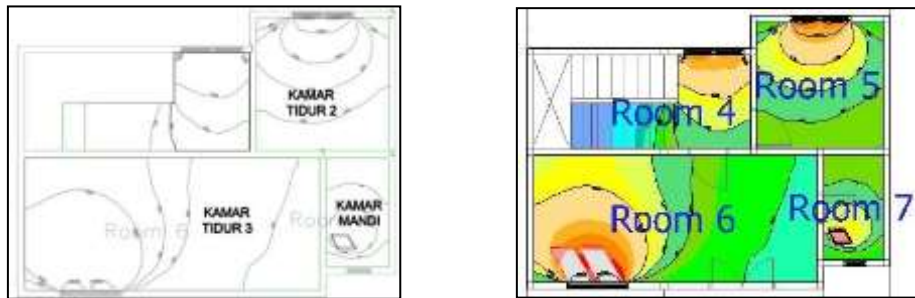


Figure 4.17 Analysis of Natural Lighting Floor 2
Source: Private Sports, 2023

Thus, the building has met the benchmark by applying natural lighting by 50% of the area of the House. The percentage of each room is, living room and kitchen at 69.2%, bedroom 1 at 70%, bedroom 2 at 71.6%, bedroom 3 at 54.4%, bathroom 1st floor at 6.6% and bathroom 2nd floor at 58.9%.

4.4.3 Minimization of Pollutant Sources

After interviews with homeowners and analyzes, the building has been using low VOCsnya paint. VOCs is a dangerous chemical content in the paint. In addition, the lamp products used are low mercury lamp products. The type of lamp used is E27, shown in Figure 4.19



Figure 4.18 examples of lamps and paints used at the research site
Source: Private Sports, 2023

4.4.4 Spatial Comfort

The total area of the building as previously calculated is 95 m², meanwhile, the number of residents if inhabited by about 5 people based on the total number of rooms inhabited by 1-2 people, so that a comparison between the total area and the number of residents is $95/5 = 19$ m². So that each resident has an area of 19 m². Meanwhile, if analyzed based on the area of the room, then for the 1st floor children's room has an area of 9 m², 2nd floor children's room has an area of 9 m² and the 2nd floor main room has an area of 19.5 m² occupied by husband and wife then the area of space obtained by both is 9.75 m². Thus, based on the results of these calculations, every 1 person has an area of ± 9 m²

Based on the results of the analysis that has been done, then obtained a temporary conclusion to answer the formulation of the problem, before further discussion. Based on the results of the analysis, it is

known that the percentage of successful application of green building principles in Citraland Gama City Housing to the overall benchmark is 57.6%. The success rate for each category based on the benchmark value of each category is shown in Table 4.3 below.

Table 4.3 results of the analysis of benchmarks Greenship

No	Categorie s	The Value of The Benchmark According to The Greenship Standard	The Value Obtained Is Basedon The Results Of The Analysis	Percentage of analysis results against benchmarks
1	Appropriate Site Development	15	10	66,6%
2	Energy Efficiency and Conservation	17	7	52,9%
3	Water Conservation	13	6	46,1%
4	Indoor Health and Comfort	14	9	64,3%
Total Value		59	32	57,6%

In the table above, it can be seen that the appropriate land use category is only able to meet 66.6% of the existing benchmarks, as well as the efficiency and Energy Conservation category, which is only able to meet 52.9% of the existing benchmarks. While the category of water conservation with the lowest percentage, which is only able to meet 46.1% of existing benchmarks and Health and comfort of space that has the largest percentage that can meet 57.6% of existing benchmarks.

4.2 Discussion on Each Category

As explained in the analysis section, the discussion of green building principles in Citralan Gama City Housing. Discussions were conducted on the four categories including the categories of land use, energy efficiency and conservation, water efficiency, and health and comfort of space.

4.2.1 Appropriate Site Development Category

In the appropriate land use category, based on the results of the analysis carried out, the buildings analyzed have managed to meet several criteria and benchmarks that have been required. Thus, the developer has paid attention to the aspects of land use based on land use that has been regulated, where the site is in the area of Housing and settlement allotment. As for the zone area adjacent to the activities of the central government, trade and service activities, education and health centers and offices. Enabling all aspects, especially related to supporting infrastructure, public facilities and transportation, to be met and easily accessible so that the three criteria, namely supporting infrastructure, community accessibility, and public transportation, can be met.

In the green base area is appropriate based on regulations and technical guidelines where 10% must be used for the park area. Meanwhile, in the Avellino type Citraland Gamacity building, it obtained 22.5% for the park area. The plants in the buildings analyzed are tabebuaya tree and Fir candle. The plants in the research site still come from local nurseries taken in the Mardisan Flower Garden and surrounding areas with a distance of 14.2 km.

In the backyard, a canopy has been installed by the residents of the house and a gutter has been installed so that it regulates the circulation of rainwater that falls on the roof of the House. The need to install gutters so that rainwater does not directly flow freely from the roof and can cause seepage on the ceiling or wall. Water seepage that is not controlled with a good gutter installation can cause a short circuit in the electrical cable that is in the ceiling.

4.2.2 Energy Efficiency and conservation Category

In the category of energy efficiency and conservation, based on the results of the analysis, the buildings analyzed have managed to meet several criteria and benchmarks that have been required. The criteria that have a value, either full or not full, consists of criteria for electricity meters, sub meters, air conditioning, heat reduction. Meanwhile, criteria that did not meet the existing benchmarks consisted of artificial lighting, energy-efficient household appliances and renewable energy sources.

In the analysis that has been done shows that, the electricity meter in the building type Avollina use electricity meter from PLN with power 2200 VA. The type of electricity meter used is a prepaid system or electricity token. For air conditioning surveys have been conducted there are three benchmarks that affect the thermal comfort in a room as described in the sub-analysis, the results are 13.55% ventilation area has exceeded the specified. Ventilation benchmarks are useful for creating the availability of clean air that is low in pollution with the aim of maintaining humidity and a comfortable temperature for residents in the building, thus affecting the productivity and activities of residents.

Ventilation is also something that must be considered in every room, including in the kitchen and bathroom area. This building also has ventilation in the kitchen and bathroom area which is useful for air circulation and light. Good circulation will prevent the bathroom from unpleasant odors and make the air cleaner, while the reflection of light from the ventilation itself can reduce the use of lights and can save electricity expenditure.

In addition to ventilation, the need to use building materials that can reduce heat on all walls and floors. Related materials used to reduce heat on the wall the developer uses red brick because it can absorb temperature well and make the wall resistant to fire. While the material used to reduce heat on the floor, the developer uses granite 60x60 cm. granite floors have pores that are able to absorb the cold so that the floor becomes cool.

4.2.3 Water Conservation Category

In the category of water conservation, based on the results of the analysis carried out, the buildings analyzed have managed to meet several criteria and benchmarks that have been required, among others, related to water meters, water-saving output devices and wastewater treatment. Meanwhile, some aspects that have not been met are related to the use of rainwater and water-efficient irrigation.

The Developer has made water conservation efforts shown by the selection of water-saving output tools ranging from toilets, showers and water taps. In addition, there is a wastewater treatment system, to overcome wastewater treatment, the developer installed a grease trap on the kitchen sink so that the wasted fat and oil can be captured so that it does not directly enter the piping line.

In addition, to treat wastewater, the developer only uses conventional septic tanks instead of using septic tanks that have bio filters. If using a septic tank bio filter the value of the wastewater treatment criteria will increase because it is more environmentally friendly. The working method the room in the septic tank is designed with several bulkheads so that the bulkheads in addition to collecting dirt also serve as a filtration medium so that it can process wastewater to be safe for the environment.

4.2.4 Indoor Health and Comfort Category

In the category of Health and comfort in space, based on the results of the analysis carried out, the buildings analyzed have managed to meet several criteria and benchmarks that have been required, among others, related to clean air circulation, minimization of pollutant sources and spatial comfort. Meanwhile, some aspects that have not been met are related to natural lighting, visual comfort and noise levels.

Based on the results of the analysis, it shows that the developer has paid attention to aspects of Health and comfort in the space under construction. From the results of the analysis carried out related to clean air circulation, the total ventilation area is 13.55% of the building floor area. The total area of ventilation also includes on the bathroom bouvenlight and kitchen windows so get a value from this criterion. The function of this criterion is to maintain clean air circulation in the house and maintain the needs of the air rate so that the health and thermal comfort of residents can be maintained and can also save energy.

On the criteria of minimization of pollutant sources, buildings that are analyzed using paints and coatings that contain low levels of VOCs and use low mercury led lights. This is in order to prevent or reduce air contamination in the room from the emission of interior materials that can harm health. In addition to reducing the source of pollutants, the developer also thinks about the spatial comfort that the standard needs a minimum area of 9 m² per person. In buildings that have been analyzed, if inhabited by about 4 people based on the number of rooms inhabited by 1-2 people, so that the area of the room in the house is 9.75 m² per person. The need for spatial comfort in order to provide comfort, feasibility and health to residents in terms of meeting the needs of space based on their activities.

5. CONCLUSION

The results of the analysis of buildings Citraland Gama City type-Avellino average value is only able to meet 57.6% related to the application of green building principles of the total benchmarks contained in Greenship based on 4 categories consisting of Land Use, Efficiency and energy conservation, water conservation, as well as health and comfort in space. Of the four categories, the most dominant, or the one with the highest value is the Land Use aspect that is able to meet 66.6% of the total existing benchmarks. Based on the analysis carried out, the benchmarks that were successfully assessed included land kesesuaian, green base areas, green areas, supporting infrastructure, community accessibility, public transportation and handling of rainwater runoff. On the aspect of Health and comfort in space with a percentage of 64.3% of the existing benchmarks. Based on the analysis conducted, the benchmarks that successfully received an assessment include non-asbestos, clean air circulation, minimization of pollutant sources and spatial comfort. On the aspect of Water Conservation with a percentage of 46.1% of the existing benchmarks. Based on the analysis carried out, the benchmarks that successfully received an assessment include water meters, water-efficient output devices and wastewater treatment. Meanwhile, the lowest is in the aspect of efficiency and energy conservation with a percentage of 52.9% of the existing benchmarks.

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