

Implementation of Green Building Concept on the Modern Regional Library of Southeast Sulawesi



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green building,
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ABSTRACT

This study aims to examine the implementation of green building concept on the Modern Regional Library of Southeast Sulawesi building. The method used in this study is qualitative-observation method based on the analysis carried out using several criteria based on GreenShip New Building by Green Building Council Indonesia (GBCI) which consist of: 1) Appropriate Site Development, 2) Energy Efficiency & Conservation, 3) Water Conservation, 4) Material Resources & Cycle, 5) Indoor Health & Comfort, as well as 6) Building Environmental Management. This study concludes that the Modern Regional Library of Southeast Sulawesi building has implement some of the green building criterias based on the GreenShip New Buildings by GBCI.

1. INTRODUCTION

Architecture field has experienced increased development as time goes by & technology advanced. However, the development has also been impactful for the environment. Construction & property sector has made great impact for the environmental issues locally & globally: pollution, toxic waste, resources depletion, land use, as well as biological degradation [1]. Therefore, architects around the world need to rethink & find innovation to create a more eco-friendly building design towards sustainable architecture.

Indonesia experienced immense development on architecture field in which buildings with 'green concept' are emerging in the state. There are more regulations or policies are made in order to create a green building. This is important,

because green building decrease the negative impact on human's health, environment, economy & communities starting from the design process, construction design, implementation & building maintenance [2]. Therefore, it is necessary for Indonesian architect to be aware of green building concept.

Green Building Council Indonesia (GBCI) is a private building council in Indonesia aims to promote the implementation of green building. GBCI compose some criterias used to measure the implementation of green building in building varies based on the type of the buildings. One of the reference of green building certification founded by GBCI is GreenShip New Building. Stages of GreenShip are Design Recognition (DR) & Final Assessment (FA) [3]. Types of project that can be measured using GreenShip New Building, are as follows [4]:



1) New building on an empty site or in an integrated area;

2) Renovation activities of at least 90% of the weight of mechanical electrical work or structural work, on land that has been built.

GreenShip New Building contains criterias as well as benchmarks which can be used to measure the implemetation of green building on a new building & currently the rating tools have been updated from Version 1.0 [5] to Version 1.1 [6], & Version 1.2 . The summary for recent GreenShip New Building Version 1.2 [5] is as follows:

TABLE I. SUMMARY OF GREENSHIP NEW BUILDING

| No. | Criteria | Benchmarks |
|-----|-----------------------------------|---|
| 1. | Appropriate Site Development | a) Site Selection b) Community Accessibility c) Public Transportation d) Bicycle Facility e) Site Landscaping f) Micro Climate g) Stormwater Management |
| 2. | Energy Efficiency Measure | a) Electrical Sub Metering b) OTTV Calculation c) Energy Efficiency Measure d) Natural Lighting e) Ventilation f) Climate Change Impact g) Site Landscaping h) On Site Renewable Energy |
| 3. | Water Conservations | a) Water Metering b) Water Calculation c) Water Use Reduction d) Water Fixtures e) Water Recycling f) Alternative Water Resource g) Rainwater Harvesting h) Water Efficiency Landscaping |
| 4. | Material Resources & Cycle | a) Fundamental Refrigerant b) Building & Material Reuse c) Environmentally Friendly Material d) Non ODS Usage e) Certified Wood f) Prefab Material g) Regional Material |
| 5. | Indoor Health & Comfort | a) Outdoor Air Introduction b) CO ₂ Monitoring c) Environmental Tobacco Smoke Control d) Chemical Pollutant e) Outside View f) Visual Comfort g) Thermal Comfort h) Acoustic Level |
| 6. | Building Environmental Management | a) Basic Waste Management b) GP as Member of Project Team c) Pollution of Construction Activity d) Advanced Waste Management e) Proper Commissioning f) Green Building Submission Data g) Fit Out Agreement h) Occupant Survey |

Modern Regional Library of Southeast

Sulawesi is a new building in Indonesia located in Kendari. This library also adopt green building aspects on its design & construction. The library will be part of Sulawesi Tenggara Cerdas Center (Southeast Sulawesi Smart Center) expected to become a pilot in Eastern Indonesia & become a center of learning & education in Southeast Sulawesi.

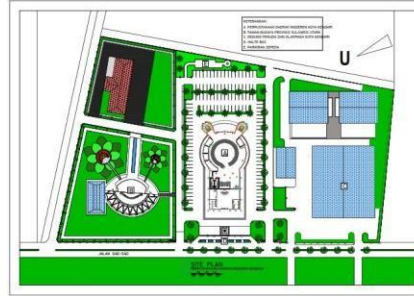


Fig. 1. Site Plan of Modern Regional Library of Southeast Sulawesi building construction (Author Documentation, 2021)

This study aims to examine green building concept of the Modern Regional Library of Southeast Sulawesi based on GreenShip New Building by GBCI.

2. METHOD

The study method used in this study is qualitative- observation. Qualitative method is used to determine the problem through approach on the building as well as the observation carried out to gather datas needed through daring or in-field to support the study.

The study focus on examines how the implementation of green buildings embodied in the Modern Regional Library of Southeast Sulawesi Building in terms of the GreenShip New Building benchmark set by GBCI. In this study, the implementation of the GreenShip New Building criteria will be seen based on the final

design of the library & what has been realized in building construction in the field.

3. RESULT AND DISCUSSION

A. General Description of Modern Regional Library of Southeast Sulawesi

Modern Regional Library of Southeast Sulawesi is a new building built in 2019 located in Sao-Sao Street, Bende Sub- District, Kadia District, Kendari City, Province of Southeast Sulawesi, Indonesia. The building lies between two of Kendari's landmarks which are Pemuda Sports Arena & Cultural Park. The library currently under construction & the progress has been around 80%. Final design process has been carried out & the government of Southeast Sulawesi strive to finish the building. The building expected to become a vital building for the community as well as being the model for other regions as a "Smart Center" where the place become the melting pot for educations around the region, especially in East Indonesia.



Fig. 2. Current progress of Modern Regional Library of Southeast Sulawesi building construction (Author Documentation, 2021)

B. Benchmarks of Greenship New Building Eligibility that must be fulfilled for the building in order

to go through the certification [6] as follows:

- 1) Minimum building area is 2500 m²;
- 2) Data Project transparency;
- 3) Complied with the detailed spatial planning;
- 4) Ownership of Environmental Impact Analysis (AMDAL), Environmental Management Plan (UKL) or Environmental Monitoring Effort (UPL);
- 5) Compliance with Fire Protection Standard;
- 6) Compliance with Earthquake Resistance Standard;
- 7) Compliance with Accessibility Standard for Disabled People.

In order to find out the green building concept applied on the building based on *Greenship New Building*, the study sees the benchmarks which have been achieved based on the building planning & what has been realized in the field.

1) Appropriate Site Development

- a.) Site Selection: The construction area of this building is equipped with several city infrastructure including road networks, lighting & electricity networks, drainage networks, clean water networks, telephone networks, fiber optic networks, garbage disposal systems & fire extinguishing systems & the building area has the potential to become an Science Technology Park (STP) Area.
- b.) Community Accesibility: The building is accesible to all comunities. There are some of public facilities that can be accessed around 1500 m through the streets from site, namely public park (Cultural Park) & sport field (GOR Pemuda) beside the building, eating place (KUKM Culinary Center of Kendari, 550 m from site), medical facilities (Griya Husada Bakti Hospital (600 m from site) & pharmacies (S Farma & Sekar Pharmacy 500 m from site). Some of the government offices among them Indonesian Supreme Audit Agency of Southeast Sulawesi or BPK RI Sultra (550 m from site), Pratama Tax Service Office (450 m from site), & Kendari Mayor Office (1,2



km from the site). Fire Department located 1,5 km from the site. Photocopy center (Laya Foto Copy located 170m from the site). There are also worship place near the site (Al-Muhtasib Mosque, 500 m from the site). Banking facilities like Local Development Bank of Southeast Sulawesi (1,2 km from site) as well as some of ATM located around 500 m from site. Therefore, the building met the prerequisites for Greenship New Building related to community accesibility.

- c.) Public Transportation: The access to public transportation has been planned to be located in front of the building aims to provide bus stops in front of the building.



Fig. 3. 3D image of the bus stop located in front of the Modern Regional Library of Southeast Sulawesi building (Author, 2021)

- d.) Bicycle Facility: The existence of bicycle facilities of the library is planned to be located in the parking area of the building.



Fig. 4. 3D image of the bicycle parking

area located outside the Modern Regional Library of Southeast Sulawesi (Author, 2021)

- e.) Site Landscaping: Landscaping on the site will be filled with plants & trees cultivated locally around the area to provide coolness for building users.



Fig. 5. 3D image of the pedestrian area with softscape vegetation for the site landscaping in Modern Regional Library of Southeast Sulawesi (Author, 2021)

In addition, there is also a rooftop garden at the building to equipped with vegetation so that 40% of the vegetation on the land can be achieved in the building coverage.



Fig. 6. 3D image of the Modern Regional Library of Southeast Sulawesi's rooftop garden (Author, 2021)

- f.) Micro Climate: The library building design does not use 50% green roof but it is planned to have a rooftop with vegetation for building users which also can reduce the heat island effect and also equipped with canopy roof.

Fig. 7. 3D image of the canopy roof on the Modern Regional of Southeast Sulawesi Rooftop Garden to reduce heat-island effect (Author, 2021)

As for the landscape design in the

ground floor is planned to have vegetation (softscape) on the pedestrian area main circulation which protects pedestrian from the sun's heat or exposure to strong winds.

- g.) Stormwater Management: The management of rainwater runoff in this building is that rainwater is collected in a rainwater storage installation on the top floor then to the lower floor where it is needed & then the rest is discharged to drainage.

2) Energy Efficiency Measure

- a.) Electrical Sub Metering: Installation of the electric sub-meter that is conventionally used in this building but it has not been planned that the installation of a kWh meter is carried out in this building to measure the electricity consumption in each load group & equipment system (air conditioning system, light, contact boxes & other load systems) to monitor energy use.
- b.) OTTV Calculation: Overall Thermal Transfer Value (OOTV) calculations based on SNI 03-6389-2011 concerning the Conservation of Building Envelope Energy in Buildings have not been implemented.
- c.) Energy Efficiency Measure: Energy saving measures in the building have not encompassed the energy use stage of modeling software or OTTV calculations in accordance with SNI. The vertical transportation contained in this building, namely the elevator, has not been tested by the Traffic Analysis Regenerative Drive System, but it is planned to have energy-saving features such as motion sensors/sleep mode. However, a significant energy saving step in this building is the use of a circular ramp from the ground floor to the top floor which is also disability- friendly so as to reduce the

use of elevators.



Fig. 8. 3D image of circular ramp in the Modern Regional Library of Southeast Sulawesi (Author, 2021)

- d.) Natural Lighting: The lighting in the library building uses natural lighting which is manifested through the facade on the neck of the dome or building voids so that light can enter to illuminate the building during the day. This supports reduced energy consumption & natural lighting.

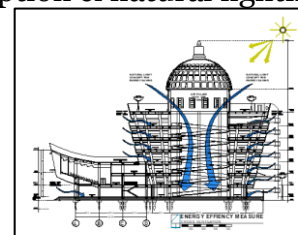


Fig. 9. Illustration of Natural Lighting on Modern Regional Library of Southeast Sulawesi building (Author, 2021)

- e.) Ventilation: The dominant ventilation system in this building is cross-ventilation by utilizing a void/skylight in the middle of the building, which flows the air through the dome neck. However, several rooms still use AC such as theater rooms & meeting rooms.

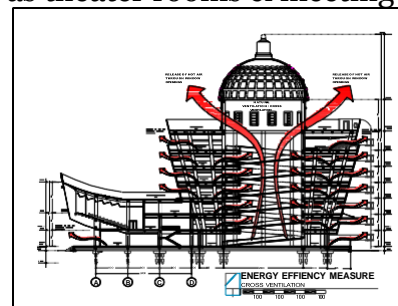


Fig. 10. Illustration of Cross-Ventilation on Modern Regional Library of Southeast Sulawesi building (Author Analysis, 2021)

building does not yet use a water feature that can guarantee high efficiency but still uses conventional water features.

- f.) **Climate Change Impact:** This building does not yet have data related to the calculation of CO₂ emission reduction which is measured from the difference in energy requirements between the designed building & the baseline building based on the grid emission factor that has been stipulated in the DNA Decree on B / 277 / Dep.III / LH / 01/2009.
- g.) **On Site Renewable Energy:** There will be street lamps on the parking lot that are powered by solar energy harvested from the sunlight during daylight in order to save more energy in the building.

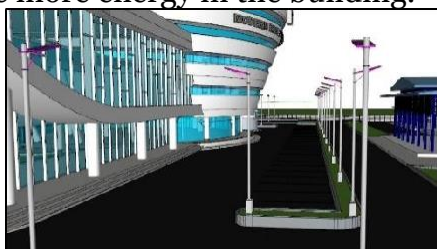


Fig. 11. 3D Image of Solar-Powered Lamps on Modern Regional Library of Southeast Sulawesi's parking area (Author Analysis, 2021)

3) **Water Conservations**

- a.) **Water Metering:** In the building, a conventional water meter is placed which can calculate the volume of water using tap water (PDAM water) & groundwater/deep well water. Water from the concrete slab is collected in the ground tank which is then used for building needs such as watering plants in the building landscape, etc.
- b.) **Water Calculation:** This library building does not yet have a water use calculation based on the form from GBCI which can be calculated when the building operates.
- c.) **Water Reduction Use:** Reduction or decrease in water use, especially related to clean water consumption, cannot be fully calculated in this building because the building is not fully functional.
- d.) **Water Fixtures:** The water feature in the

- e.) Water Recycling: The library building has not planned the application of water recycling using a gray water system, but there is rainwater reuse for watering plants.
- f.) Alternative Water Resources: The alternative water source that is planned for this building besides the main source of water, namely PDAM water & ground water, is rainwater to irrigate plants in the building landscape, but for AC condensation water & water used for ablution it has not been planned to be an alternative water source.
- g.) Rainwater Harvesting: In the building there will be an installation of rainwater storage where the collected water will be distributed then used as irrigation for plants so that it does not use the main water source & therefore save water.

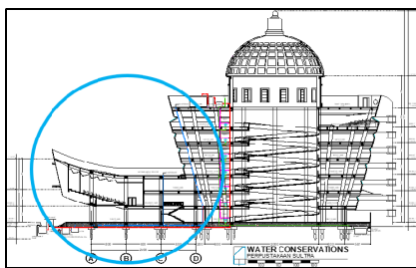


Fig. 12. Illustration of Rainwater Harvesting on Modern Regional Library of Southeast Sulawesi building (Author Analysis, 2021)

- h.) Water Efficiency Landscaping: The efficient use of landscape water in the planning of this building has not completely been able to minimize the use of PDAM water & groundwater for landscape irrigation needs. This is because the main source of water still uses PDAM water & groundwater & there is no innovative technology applied to control water needs for landscaping.

4) Material Resources & Cycle

- a.) Fundamental Refrigerant: Some rooms in the library building are planned to

use air conditioning or air conditioning which of course contains chloro fluoro-carbon (CFC) as refrigerant & several points will be placed with fire extinguisher which still contains halon as a fire extinguisher so that it has the potential to damage ozone.

- b.) Building & Material Reuse: The majority of building materials used are new materials, not old building materials from other places.
- c.) Environmentally Friendly Material: The majority of materials used in this library are not completely environmentally friendly, this is because the materials are not the result of a recycled process & do not come from renewable sources.
- d.) Non ODS Usage: According to plan, the room that uses AC in the building still uses fundamental refrigerant materials or contains chloro-floro carbon (CFC) which has the potential to damage the ozone layer.

- e.) Certified Wood: The use of wood in this building is classified as minimal, but it is certain that the use of wood in the project is certified wood obtained legally or not from illegal logging, in accordance with government regulations & Indonesian National Standard (SNI)

- f.) Prefab Material: In the construction of the library building, the majority of the materials used are modular materials or fabricated materials, namely materials that have been previously processed in the factory such as ceramics used, etc. so that it is sufficient to reduce construction waste.

- g.) Regional Material: All of the materials used in the project are obtained on the regional area, therefore reducing the carbon footprint of transportation modes for distribution & promoting domestic economic growth.

5) Indoor Health & Comfort

a.) Outdoor Air Introduction: The design used in this building makes it possible to obtain air from outside the building, as can be seen in the following illustration.

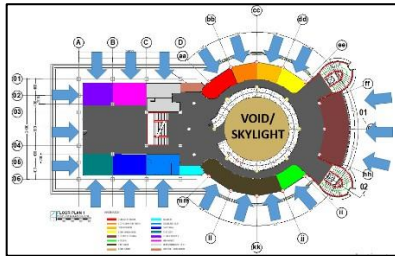


Fig. 13. Illustration of outdoor air introduction on the Modern Regional Library of Southeast Sulawesi building floor plan. (Author, 2021)

b.) CO₂ Monitoring: Calculation of CO₂ in the room in the building has not been carried out, but in the calculation & the installation of a carbon dioxide gas sensor has not been planned.

c.) Environmental Tobacco Smoke Control: In relation to this, in the planning, every room is smoke-free in order to ensure the comfort of building users, but it cannot be promoted because the building has not been functional.

d.) Chemical Pollutant: In the building construction process, of course, construction waste is generated which causes chemical pollutants but there is no data regarding chemical pollutants contained in the generated construction waste.

e.) Outside View: The building design accommodates or allows building users to look outside the building where the surrounding buildings are equipped with transparent glass that is anti-solar radiation so that users still get comfortable visuals. The outside view for the ground floor has an Net Lettable Area (NLA) above 70%, while the upper floor of the prep library uses around 50% of the NLA & certain rooms do not use too many openings such as the

theater room & meeting room.

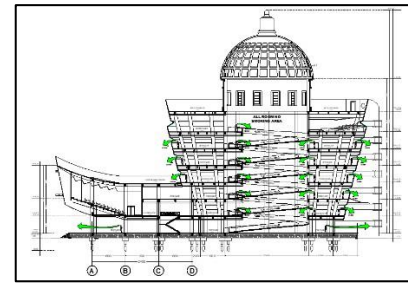


Fig. 14. Illustration of outside view accommodated on the Modern Regional Building of Southeast Sulawesi.

f.) Visual Comfort: The use of lights in buildings uses led lights with appropriate illumination to support the visibility of building users.

g.) Thermal Comfort: Thermal comfort required for the building is a general temperature of 25°C & a relative humidity of 60%, which in this building can be achieved by the presence of voids from the ground floor to the top floor (8th Floor) to maintain a stable temperature & humidity in the room.

h.) Acoustic Level: Regarding the acoustic level in this building, landscaping around the area in the form of plants that will reduce noise from the streets. For indoor noise, it is muted by using acoustic damper material for theater & meeting rooms.



Fig. 15. 3D Image of plants around the building act as the noise-reducing tools for the Modern Regional Building of Southeast Sulawesi landscape. (Author, 2021)

6) Building Environmental Management

a.) Basic Waste Management: The management of waste management in

the library building is planned in the form of a waste management system in which the waste generated in the building is collected in a garbage collection area, then sorted manually by type of organic, inorganic & hazardous toxic materials (B3) then the waste is brought to the TPA.

- b.) GP as Member of Project Team: The implementation of this project has not involved GREENSHIP Professional (GP) certified experts, only using experts with qualifications required in the Terms of Reference for activities stipulated by the Public Works Office of Southeast Sulawesi Province. So that this project has not specifically led to the achievement of the Greenship New Building criteria.
- c.) Pollution of Construction Activity: Pollution from the construction activities of the library building is collected then disposed directly to the landfill. Therefore, it is less environmentally friendly.
- d.) Advanced Waste Management: Regarding advanced waste management, no advanced waste management is carried out which is managed independently to reduce the burden on TPA. Construction waste is generally taken directly to the landfill.
- e.) Proper Commissioning: Testing commissioning procedures in accordance with the GBCI have not been implemented but testing commissioning procedures have generally been carried out by the task force to optimize the function & performance of the planned equipment such as soil testing (sondir & boring), iron tensile test, etc & confirming all measuring adjusting instruments installed in accordance with the design & technical specifications related to proper commissioning components.
- f.) Green Building Submission Data:

Comprehensive Green Building Data in accordance with the format from GBCI & statements related to the willingness to fulfill green building certification within the specified time has not been implemented. This is because basically this building has not planned to fully participate in the GBCI certification. However, data such as Environmental Impact Analysis (AMDAL) or Environmental Management Efforts (UKL) or Environmental Monitoring Efforts (UPL) submitted by the Provincial Government of Southeast Sulawesi to examine the environmental impacts arising from the construction & existence of this building.

- g.) Fit Out Agreement: Regarding the fit out agreement (agreement related to the use of certified wood, training for building management, & indoor air quality (IAQ) management for buildings) has not been carried out, but it does not rule out the possibility that the agreement can be realized in the future.
- h.) Occupant Survey: The building user survey cannot be carried out because the building is still in the construction process & it has not been opened to the public.

4. CONCLUSION

After seeing & comparing the criteria & benchmarks of the Greenship New Building observed in the Modern Regional Library of Southeast Sulawesi, it is concluded that several aspects of the building have met the criteria & benchmark, especially those related to Appropriate Site Development in which the site selection & has met all of the criterias. Regarding the energy conservation both related to electrical energy or water energy in buildings has been planned to be efficient & saving energy though there are still some of the features & energy



calculation that needs to be carried out

according to GBCI Form in order to comply with GreenShip New Building. However, the use & processing of materials in building construction are not entirely environmentally friendly. Related to indoor health & comfort, the design has been planned to comply to visual & thermal comfort for building users, while for building environmental management it is reasonable to not meet the criteria yet since the building has not been planned to participate in GBCI certification but the design has the potential to become a green building with some adjustments referring to GreenShip New Building by GBCI.

Furthermore, the steps necessary to be taken to achieve the green building predicate for the Modern Regional Library of Southeast Sulawesi based on the GreenShip New Building are as follows: regarding appropriate site development, the facilities for public transportation should be provided as well as bicycle facility. Related to energy conservation calculations, especially electricity, OTTV calculations needs to be carried out to calculate energy on the building so that energy saving steps can be taken. Regarding water conservation, it is necessary to upgrade water meters & water features that are more water efficient for buildings if possible, maximizing water recycling & water reuse which is not limited only to rainwater runoff but also maximizes the use of AC condensation water & used ablution water for water needs in the building. Regarding material recycle & reuse, switching to non-CFC material for the equipments like AC in the room or non-halon fire extinguisher as well as finding ways to reuse/recycle the construction waste to reduce landfill load. Regarding indoor health & comfort criteria, it is necessary to enforce a smoking-free area regulation which must be obeyed by

building visitors, installing sensors to detect levels CO₂ in the room. Regarding building environmental management criteria, building managers in the future need to actively update environmental data based on the GreenShip New Building form set by GBCI, involving GP in fulfilling assessments, planning & implementing advanced waste management, implementing fit out agreements & conducting surveys on building users to further assess their response. If the steps are taken, the building has the potential to achieve the green building title based on GBCI GreenShip if the GreenShip assessment being carried out in the future.

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