

SUSTAINABILITY PRACTICES IN RRIT INFRASTRUCTURE: A CASE STUDY OF CIVIL & MECHANICAL BLOCK

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Abstract— Sustainable infrastructure plays a crucial role in modern civil engineering. This study evaluates the sustainability practices implemented in the Civil and Mechanical Blocks of R.R Institute Of Technology, Bangalore, with reference to green building principles and established frameworks such as GRIHA. A systematic methodology involving literature review, data collection, and performance assessment was adopted to analyze key parameters, including energy efficiency, water management, waste management, and occupant comfort.

I. INTRODUCTION

Sustainable development in the construction sector has increasingly focused on the adoption of green building practices that promote efficient resource use, environmental protection, and long-term performance. In this study, the Civil and Mechanical Blocks of RRIT are examined to evaluate how effectively the existing infrastructure incorporates sustainability principles and meets current environmental standards. Green buildings aim to reduce ecological impact while enhancing energy efficiency, occupant comfort, and overall building performance.

Modern sustainable design goes beyond material selection and includes strategies such as water conservation, waste management, pollution reduction, and the integration of renewable energy systems. Educational institutions, in particular, have a significant responsibility in demonstrating sustainable practices, as their built environment directly influences students and future professionals. Implementing such strategies not only minimizes environmental impact but also promotes awareness and responsible engineering practices. A structured assessment of the buildings helps identify both strengths and performance gaps, especially in areas like ventilation, energy optimization, and water management. Established frameworks such as GRIHA, LEED, and the Sustainable Development Goals provide standardized benchmarks for evaluation.



Fig.1 RRIT Civil & Mechanical Block

II. LITERATURE REVIEW

Hong Jun Jia, Hui Wang

“Green Building and Sustainable Development”, 2012, IOSR Journal of mechanical and civil engineering (IOSR-JMCE) Conference Series: The paper defines green building as a key approach for sustainable development, outlining its concepts, features, and the need for continuous learning to meet future environmental goals.

Laura B Cole

“Green Building Literacy: Framework for advancing green building education” 2019. International journal of STEM Education, v6 article-18, this study promotes green building literacy by integrating sustainability concepts into STEM education through system-based teaching framework.

Jeremy Gibberd

“Green Building Technologies”, 2021 Development and application of green building technologies. The chapter explains how green building technologies reduces energy use and greenhouse gas emissions in buildings. It presents methods to integrate these technologies for a sustainable and climate-resilient built environment.

Gayathri S Shivakumar

Study referenced in the 2023 International journal of Research and Review paper "**Green Building Materials**", demonstrated that the paper reviews green building materials and their roles in promoting sustainable construction. It highlights their types, benefits, challenges, and recent advancements in the field.

III. OBJECTIVES

1. To evaluate the energy efficiency and resource utilization.
2. To assess the implementation of sustainable design strategies.
3. To identify gaps and propose improvements that enhance environmental performance.
4. To promote long-term sustainability of the college infrastructure.

IV. METHODOLOGY

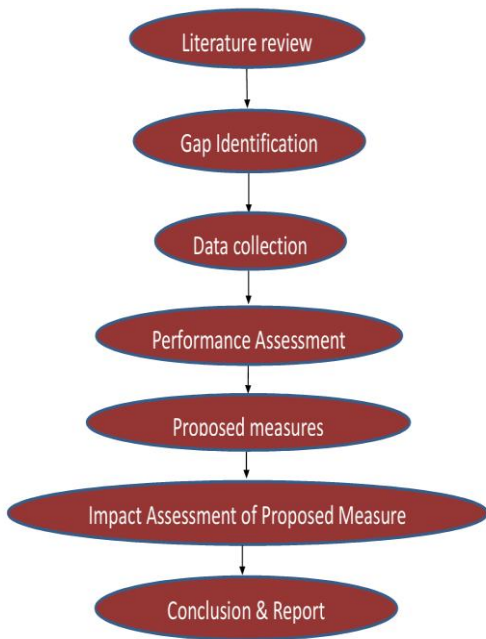


Fig.2 Diagram of Methodology

V. ASSESSMENT OF EXISTING BUILDING

SL.NO	CATEGORIES	MAX POINTS
1	Site Planning and Construction Management	14
2	Energy Efficiency	25
3	Water Management	13
4	Solid Waste Management	6
5	Air and Water pollution control	9
6	Building Materials and Resources	14
7	Occupant Comfort and Well-being	9
8	Social Aspects	4
9	Performance Monitoring	6

1. SITE PLANNING AND CONSTRUCTION MANAGEMENT

- As per the GRIHA differential rating system the maximum points allocated to site planning and construction management is 14 points.
- As per rating system, for 'Low impact design strategies' criteria, 2 points are reduced.

Reason: There is no E-vehicle parking facility for at least 5% of the total four wheeler parking space along with charging facility for E-vehicles and adequate signage. Additionally there is no designated vehicular tracks for NMT vehicles for site areas.

- As per the rating system for, 'Construction Management', no points are deducted. The building under assessment is rated by 12 points.

2. ENERGY EFFICIENCY:

- As per the GRIHA differential rating system the maximum points allocated for energy efficiency is 25 points.
- As per rating system, for 'Energy Optimization' criteria, 8 points are reduced.

Reason: The heat gain through the building envelope (air- conditioned and hybrid buildings) is above the GRIHA threshold for peak heat gain.

100% of exterior lighting fixtures (lamp + ballast) does not meet the luminous efficacy of 80lm/W. No installation of on-site and off-site RE system to offset a part of the annual energy consumption of internal artificial lighting, and HVAC systems. The building under assessment is rated by **17 points**.

3. WATER MANAGEMENT:

• *As per the GRIHA differential rating system the maximum points allocated for Water Management is 13 points.*

• *As per rating system, for 'Water Demand Reduction' criteria, 4 points are reduced.*

Reason: Percentage reduction in building water demand is less than 20%.

• *As per rating system, 'Wastewater Treatment' criteria, 2 points are reduced.*

Reason: No 100% of wastewater generated on-site is treated through either a chemical-based or a natural wastewater treatment system. No 100% of wastewater is segregated (into grey water and black water) and treated independently on-site.

• *As per rating system, 'Rainwater Harvesting' criteria, 5 points are reduced.*

Reason: There is no post-construction rainwater harvesting.

• *As per rating system, 'water Quality and self-sufficiency' criteria, 5 points are reduced.*

Reason: Water quality for drinking water is good. The building under assessment is rated by **3 points**.

4. SOLID WASTE MANAGEMENT:

• *As per the GRIHA differential rating system the maximum points allocated to solid waste management is 6 points.*

• *As per rating system, 'Organic Waste Treatment', 2 points are reduced.*

Reason: Organic waste generated on-site from the building and landscape areas is not quantified and not adopt strategies to treat (manure, biogas, etc). The building under assessment is rated by **4 points**.

5. AIR AND WATER POLLUTION CONTROL:

• *As per the GRIHA differential rating system the maximum points allocated to Air Water Pollution Control is 9 points.*

• *As per rating system, no points are reduced.*

Reason: The building under assessment is rated by 9 points.

6. BUILDING MATERIALS AND RESOURCES:

• *As per the GRIHA differential rating system the maximum points allocated to Building Materials And Resources is 14 points.*

• *As per rating system, no points are reduced.*

The building under assessment is rated by **14 points**.

7. OCCUPANCY COMFORT AND WELL-BEING:

• *As per the GRIHA differential rating system the maximum points allocated for Occupancy Comfort And Well-being is 9 points.*

• *As per rating system, for 'Indoor Air Quality' criteria, 3 points are reduced.*

Reason: good indoor air quality in Civil Department Room. There is no Indoor plants minimum of 1% of carpet area.

• *As per the feedback received, 3 points are reduced. The building under assessment is rated by 3 points.*

8. SOCIAL ASPECTS:

• *As per the GRIHA differential rating system the maximum points allocated for Social Aspects is 4 points.*

The building under assessment is rated by **4 points**.

9. PERFORMANCE MONITORING:

• *As per the GRIHA differential rating system the maximum points allocated for Performance Monitoring is 6 points.*

• *As per rating system, 'Smart Metering and Monitoring', 2 points are reduced.*

Reason: No digital energy meter installed to monitor the energy consumption of each unit of the building. No digital water meter installed to monitor the water consumption of each unit of the building.

The building under assessment is rated by 4 points.

VI. EXISTING BUILDING ASSESSMENT RESULT

S L · N O	CATEGORIES	MAX POIN TS	POINTS ALLOTED
1	Site planning&construction	14	12
2	Energy Efficiency	25	17
3	Water Management	13	3
4	Solid Waste Management	6	4
5	Air and water pollution control	9	9
6	Building Materials and Resources	14	14
7	Occupant Comfort and Well-being	9	3
8	Social Aspects	4	4
9	Performance Monitoring	6	4
10	Total	100	70

The assessment result of the building is found to have 3 star rating since the total points obtained is 70.

STRATEGIES: Hence the following strategies are suggested to be implemented to make the building with higher star rating:

- *Implement smart digital water meter and energy meter.*
- *Provide indoor plants to enhance indoor air quality.*
- *Improve the hygienity of washrooms.*
- *Provide proper drinking quality to enhance occupants comfort.*
- *Provide E-vehicle parking facility for at least 5% of the total four wheeler parking space along with charging facility for E-vehicles and adequate signage.*
- *Provide wastewater treatment facility.*
- *Provide Rainwater harvesting facility.*

ASSESSMENT OF EXISTING BUILDING

S L · N O	CATEGORIES	MAX POINTS	POINT S ALLOT ED	IMPR OVED POINT S
1	Site Planning and Construction Management	14	12	2
2	Energy Efficiency	25	17	-
3	Water Management	13	3	7
4	Solid Waste Management	6	4	-
5	Air and Water pollution control	9	9	-
6	Building Materials and Resources	14	14	-
7	Occupant Comfort and well-being	9	3	6
8	Social Aspects	4	4	-
9	Performance Monitoring	6	4	2
10	Total	100	70	17

VII. CONCLUSIONS

- The assessment shows that college building has implemented several sustainability measures but still has scope for improving energy efficiency and resource management.
- The evaluation of existing design strategies indicates partial effectiveness, highlighting the need for better integration and regular performance monitoring.
- Identified gaps such as inefficient energy use, limited water-saving practices, and insufficient waste management need to be addressed to enhance overall environmental performance.
- By adopting the suggested improvements, the college can significantly reduce its environmental impact and ensure long-term sustainability of its infrastructure.
- By adopting suggested improvements, the college can significantly improve the occupancy comfort and well-being in the block.

REFERENCES

- [1] **GRIHA Council (2015). GRIHA Version 2015 Manual.** Supports: All assessment categories –

site planning, energy, water, materials, waste, comfort, monitoring.

- [2] **MNRE & TERI (2010). GRIHA Manual Volume 1: Sustainable Site Planning, Construction Management & Building Operation.** Supports: Low VOC, indoor environment quality, sustainable materials, and background theory.
- [3] **World Green Building Council (2020). What is Green Building?** Supports: Definition of sustainability and green buildings used in your introduction slide.
- [4] **US Green Building Council (2019). Introduction to Green Buildings.** Supports: Green building concepts and environmental impact.
- [5] **ASHRAE Standard 62.1 (2019). Ventilation for Acceptable Indoor Air Quality.** Supports: Occupant comfort, indoor air quality issues, ventilation requirements.
- [6] **CPHEEO (2013). Manual on Sewerage and Sewage Treatment.** Supports: Water management, wastewater treatment slide.