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SUSTAINABLE CONSTRUCTION CONSIDERING LEED CERTIFICATION

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Abstract – *This paper investigates the principles and practices of sustainable design for existing college building, aiming to mitigate their environmental footprint while enhancing their functionality and resilience. The study examines various strategies and technologies employed to minimize the environmental impact of college buildings while enhancing occupant comfort, health and productivity. Through a comprehensive literature review and case study analysis, the study evaluates various approaches to retrofitting existing college buildings to meet contemporary sustainability standards. It explores the challenges and opportunities associated with upgrading building systems, improving energy-efficiency, enhancing indoor environmental quality and incorporating renewable energy technologies.*

Key Words: Sustainability, Green building, LEED

1. INTRODUCTION

As global awareness of environmental issues continues to grow, the imperative for sustainability has become increasingly prominent across various sectors. Sustainable building, also known as green building or eco-friendly construction, encompasses a holistic approach to design, construction, and operation that minimizes environmental impact while maximizing resource efficiency and occupant well-being. At its core, sustainable building seeks to harmonize human needs with those of the natural world, creating built environments that are resilient, regenerative, and conducive to sustainable living. .

This journal aims to study and analyse the parameters which are required to convert an existing building into a sustainable structure. It explores the challenges, opportunities, and innovative solutions in retrofitting and renovating these structures to align with contemporary environmental standards and to provide healthy and comfortable living spaces.

While constructing new green buildings is commendable, the transformation of existing structures presents a unique set of challenges and opportunities that merit careful examination.

This journal will examine various aspects of sustainable transformation, including energy efficiency upgrades, waste management systems, water conservation measures, indoor air quality enhancements, and the integration of renewable energy sources. Through case studies, research findings, and literature review, it aims to provide a comprehensive understanding of the strategies, technologies, and best practices involved in the sustainable revitalization of existing buildings.

In conclusion, the journey towards sustainability in existing college buildings is both a challenge and an opportunity. By embracing innovation, collaboration, and a commitment to environmental stewardship, colleges can transform their infrastructure into living laboratories of sustainability, empowering current and future generations to thrive in a rapidly changing world. This journal serves as a beacon of knowledge and inspiration for all those embarking on this transformative journey.

Sustainability rating systems serve as guidelines for designing, constructing, and operating buildings in a manner that minimizes environmental impact and promotes resource efficiency. By establishing criteria and performance benchmarks, these systems provide a standardized framework for evaluating the sustainability of buildings across different scales and typologies.

One of the most widely recognized sustainability rating systems is the Leadership in Energy and Environmental Design (LEED) system, developed by the U.S. Green Building Council (USGBC). Another prominent rating system is the Building Research Establishment Environmental Assessment Method (BREEAM), developed in the United Kingdom. GRIHA (Green Rating for Integrated Habitat Assessment) is also a sustainability rating system, developed by The Energy and Resources Institute (TERI) in collaboration with the Ministry of New and Renewable Energy (MNRE), India.

1.1LEED

LEED assesses buildings based on criteria such as energy performance, water efficiency, materials selection, and indoor environmental quality, assigning points to different sustainability measures and awarding certification levels ranging from Certified to Platinum. Among the above mentioned systems LEED is widely recognised. Hence here

we are discussing sustainable parameters as mentioned in LEED guidelines.

2. LITERATURE REVIEW

- ARE LEED CERTIFIED BUILDINGS ENERGY EFFICIENT IN PRACTICE?
  The study showed that energy efficiency of LEED certified buildings is questionable especially at lower levels.
- COMPARATIVE STUDY ON THE GREEN BUILDING RATING SYSTEM IN DEVELOPING AND DEVELOPED COUNTRIES
  Each rating system differs in its structure, indicators, and level of certification based on its specific requirements. Even with geographical differences most of the rating systems give energy consumption critical significance.
- THE FINANCIALLY OPTIMUM LEVEL FOR A GREEN OFFICE BUILDING: LEED V4 VS LEED 2009".
  With LEED v4, a credit category for location and transportation was added to all rating systems placing more emphasis and attention on reducing main contributors to global warming.
- "COMPARATIVE STUDY OF GRIHA, LEED, BREEAM RATING SYSTEMS FOR GREEN BUILDING".
  The most recommended green building evaluation criteria in India are leadership in energy and environmental design (LEED), Indian green Building Council (IGBC) And Green Rating for Integrated Habitat Assessment (GRIHA).

3. SCOPE OF WORK:

Taking the literature and various studies into consideration a case study is being done on NEW BLOCK of Jawaharlal college of engineering and technology (JCET), Lakkidi, Kerala in order to incorporate sustainability parameters such as increased water efficiency, improved air quality, increased energy efficiency, better waste management and reduced carbon emission .The methodology followed the case study analysis is mentioned in this paper

4. METHODOLOGY

As taking as a case study the existing building of JCET was studied and found that the building does not satisfies the green building criteria and it need to be renovated by considering green building guidelines to achieve certification from sustainable rating systems like LEED. By considering LEED certification levels we are aiming to achieve a GOLD level as the building is an existing one. Hence for achieving this we have work on several sustainable parameters as mentioned in LEED guidelines. The important parameters to be considered are water efficiency, energy efficiency, indoor air quality, material and resources, waste management and sustainable site. The case study includes collection various data such as floor plan of building, electricity bills etc and conducted surveys which are required.

Fig 1: SATELLITE VIEW OF JAWAHARLAL CAMPUS, LAKKIDI

- **Water efficiency:** it is the responsible use of available water without any wastage and implementing water storing practices like rainwater harvesting system. We designed a rainwater harvesting system for the building with storage tank of capacity 196cubic meter having dimensions 14*3.5*4m as shown in fig 3 and 4. Total cost of installation is estimated as Rs.6.66 Lakh (fig 5).
- **Energy efficiency:** it focusses on reducing greenhouse gas emissions by using renewable energy sources. For that we are installing solar panels on roof of the building. The size of solar plant is 402.9KW which has a system cost of 39.1 lakh.

COMPONENT	THICKNESS (mm)	INNER REINFORCEMENT		OUTER REINFORCEMENT	
		Main	Distribution	Main	Distribution
Long wall	320 with 40mm clear cover	20 mm Ø bars at 90 mm c/c	10 mm Ø bars @ 210 mm c/c	30 mm Ø bars at 150 mm c/c	10 mm Ø bars @ 210 mm c/c
Short wall	320 with 40mm clear cover	16mm Φ @ 100mm c/c	25mm Φ @ 90mm c/c	16mm Φ @ 100 mm c/c	25mm Φ @ 90mm c/c
Top slab	160 with 40mm clear cover	16mm Φ bars with 130 mm c/c	10mm Φ bars with 160 mm	16mm Φ bars with 130 mm c/c	10mm Φ bars with 160 mm
Base slab	310 with 50mm clear cover	24mm Φ bars with 110 mm c/c	8 mm Φ bar at 120 mm c/c	24mm Φ bars with 110 mm c/c	8 mm Φ bar at 120 mm c/c

FIG 2: DETAILING OF COMPONENTS OF STORAGE TANK

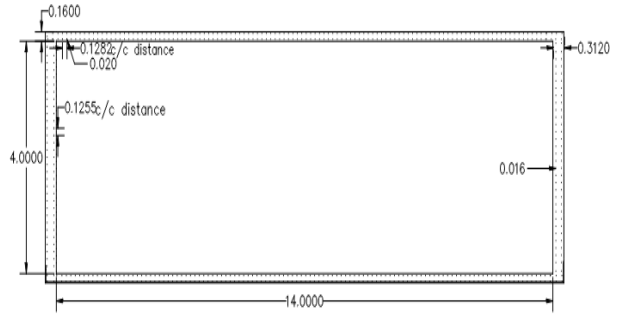

FIG 3: SECTIONAL FRONT VIEW OF STORAGE TANK

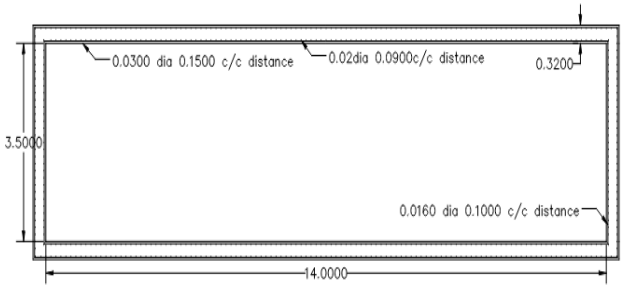

FIG 4: TOP SECTIONAL VIEW OF STORAGE TANK

SL No.	Particular	Quantity	Rate	Cost
1	Earthwork in excavation	297.216m³	130rupee/m³	Rs 38638.08
2	PCC(1:3:6)	10.08m³	3600/m³	Rs 36288.00
3	1st class brick work in 1:4 cement mortar	29.2m³	3000/m³	Rs 87600.00
4	RCC work for slab	15.725m³	9100/m³	Rs 143097.50
5	12mm plastering inside with 1:2 cement mortar	143.2m²	350/m²	Rs 50120.00
6	Steel	3805.3kg	61000/tonne	Rs 232123.3
7	**Total**			**Rs 587866.88**
8	Contigency 3%		17636.00	Rs 605502.88
9	Contractor 10%		60550.29	Rs 666053.17
10	**Grand total**			**Rs 666053.17**

FIG 5: COST ESTIMATION OF STORAGE TANK

5. CONCLUSION

From the case study the total cost of implementing sustainable parameter is 45.76 lakh. It is evident that embracing green building practices is crucial for a sustainable future. Achieving LEED certification not only enhances a building's efficiency but also reflects a commitment to responsible and environmentally conscious construction. The journey towards sustainable development is ongoing and LEED certification play a pivotal role in advancing this important cause. Whether it be LEED, BREAM or GRIHA, the ultimate aim is to create buildings that are not only environmentally responsible but also contribute positively to the well-being of occupants and the broader community.

REFERENCES

[1] Alyami S. H. and Rezgui Y. (2012). "Sustainable Building Assessment Tool Development Approach" Sustainable Cities and Society 5, 52–62

[2] Eco-Housing, (2009). "Eco-housing Assessment Criteria Version 2." Published by International Institute for Energy Conservation, Powai, Mumbai, India

[3] Greenomics, - Cost Efficiency of Green Buildings in India, (2008) Jones Lang LaSalle Meghraj

[4] GRIHA Manual Volume 1, (2010). Published by The Energy and Resources Institute Press, New Delhi, India

[5] IGBC Green New Buildings, (2014). "IGBC Green New Buildings Rating System Version 3." Published by CII Hyderabad, India

[6] Kibert, C.J. (2013). "Sustainable Construction: Green Building Design and delivery." Third edition. Published by John Wiley and Sons Inc, Hoboken, New Jersey

[7] Kevern, J. T. (2011). "Green Building and Sustainable Infrastructure: Sustainability Education for Civil Engineers." J. Professional Issues in Engineering Education and Practice,137, 107-112

[8] Kohler, N. (1999). The relevance of Green Building Challenge: an observer's perspective. Building Research and Information 27 (4/5), 309–320