A Case Study on Sustainable Construction Practices with Life Cycle Approach

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Abstract:
Sustainable construction is becoming increasingly important as we strive to reduce our environmental impact and create more sustainable future. Many governments and organizations are implementing policies and initiatives to promote sustainable construction. sustainable construction refers to the planning, designing, construction, operation, maintenance of building make an environmentally responsible and resource efficient throughout building life cycle. In this present research life cycle approach through case study is adopt. This research also differentiate between sustainable construction and conventional construction. The case study on Shri Govind guru university which is Government of Gujarat initiatives towards green construction. The university campus is green building which is resource efficient and energy efficient throughout its life span

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1. Introduction

Conditional Construction is sustainable when it is made to satisfy the demands of the present without negatively impacting the environment. The notion of sustainable construction is being aggressively promoted in developed nations like America and other European countries because to the advantages in terms of the environment, health, productivity, and prices, among other things. The cultural growth of society is relationship with the environment may be seen as a wide and far-reaching result of sustainable constructions.

By using sustainable development techniques, energy efficiency measures and green technology will help to decrease the industry's negative environmental effects. The construction industry is exceptional because it has the potential to intensely influence how these practices are

implemented, even if many other business sectors are already making efforts to be more sustainable. This occurs because of the industry's extensive usage of resources and energy.

Construction methods with a sustainability have been developed because of the evolution of construction techniques, materials and building practices over time and the increasing interest in sustainability and energy conservation. Sustainability in building is achieved via the application of both friendly to the environment materials and building techniques.

2. Literature Review

Sustainable construction

The definition of Sustainable Construction is "The practise of constructing structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation, and deconstruction procedures."

In contrast to the old viewpoint, where the key considerations were economy, usefulness and durability, sustainable construction incorporates three main dimensions: social, economic and environmental. The social component deals with topics that relate to improving people's quality of life. The economic factor covers concerns related to economics such as the creation of jobs, improving competitiveness, lowering operating/maintenance costs, job creation, creating a high-quality working environment that increases productivity and many more. The environmental component is concerned with methods for planning, building, operating/maintaining, and deconstructing that reduce negative environmental effects such air emissions, waste discharges, water resource usage, land use and others.

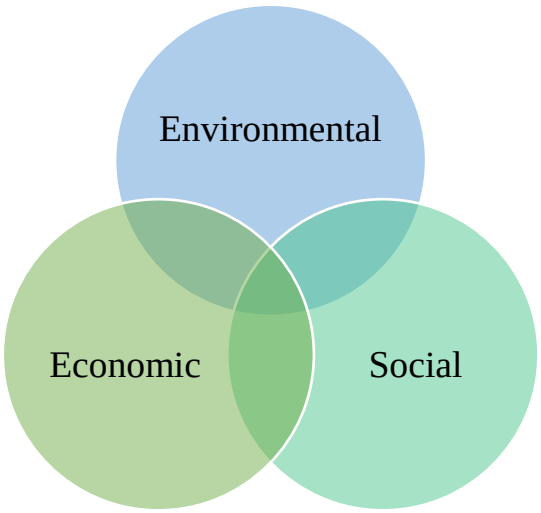

Fig 1 Sustainable Construction Parameters

[Source: Author]

Sustainable construction is important for several reasons:

1. Environmental impact: The construction industry is responsible for a significant amount of carbon emissions, waste, and resource depletion. Sustainable construction focuses on reducing these negative environmental impacts by using eco-friendly materials, reducing waste and minimizing energy use.
2. Resource conservation: Sustainable construction promotes the use of renewable resources and minimizes the use of non-renewable resources. This ensures that resources are conserved for future generations.
3. Economic benefits: Sustainable construction can lead to long-term cost savings through reduced energy and water consumption, as well as lower maintenance costs. Additionally, the use of sustainable materials can increase the value of a property.
4. Health and well-being: Sustainable construction can improve the health and well-being of building occupants by providing better indoor air quality, natural lighting, and a healthier environment overall.

Overall, sustainable construction is important for ensuring that our buildings and infrastructure are built in a way that is environmentally responsible, economically feasible, and socially beneficial.

Life cycle Assessment

Usually, Predesign, design, procurement, construction, closeout, maintenance and operation and ultimate demolition are typically included in a project lifecycle process. As the "cradle-to-grave" effects of buildings, such as material extraction, manufacture and transportation are sometimes disregarded and overwhelmed by building operation, literature has more recently concentrated on decreasing operational impacts of buildings and their emission to the environment.

A Technique for systematically examining environmental performance across a products or process is whole life cycle including the extraction of raw materials, production, usage and end-of-life (EOL) disposal and recycling is life-cycle assessment. As a result, LCA is sometimes referred to as a "cradle to grave" approach to evaluating environmental consequences.

The European Environment Agency (EEA) 1998 and the United States Environmental Protection Agency (USEPA) 2006 both adopted similar strategies. The International Organisation for Standardisation (ISO) adopted an environmental management standard in the 1990s as part of its 14000 standards series with the 14040 series focusing on establishing methodologies for LCA. The four-stage iterative framework for conducting LCA studies is a key component of the ISO standard.

Although the Process-based LCA activities have a theoretically basic and uncomplicated appearance, they require merging data from numerous, dissimilar and sometimes proprietary sources, leading to high costs, unsure quality and a large time commitment.

The environmental impacts at each stage of a building's life cycle must be evaluated in order to produce environmentally sustainable structures and among these stages, raw material extraction, manufacturing, transportation, deconstruction and recycling are of paramount importance.

Comparison between Sustainable construction and Conventional construction

Aspect	Sustainable Construction	Conventional Construction
Environmental Impact	Seeks to reduce negative impact on the environment	Often does not prioritize environmental concerns
Energy Efficiency	Emphasizes energy efficiency to minimize energy consumption and reduce emissions of greenhouse gases	May prioritize other factors over energy efficiency
Cost	May be more expensive in the short term but more cost-effective over the long term	May be less expensive in the short term but can be more costly in the long term due to higher operating costs

Health and Safety	Takes into account the health and safety of occupants, using non-toxic and low VOC materials	May prioritize other factors over health and safety
Materials	Uses sustainable and eco-friendly materials	May use non-renewable or harmful materials
Waste	Minimizes waste and promotes recycling and reuse	Generates a significant amount of waste
Water Efficiency	Promotes water efficiency and conservation	May use water inefficiently
Renewables	Incorporates renewable energy sources including solar , wind and geo-thermal	May not incorporate renewable energy sources
Adaptability	Designed for flexibility and adaptability to changing needs	May be inflexible and difficult to modify

Table 1 Comparison between sustainable and conventional construction

Case Study On Shri Govind Guru University

By virtue of Gujarat Act No. 24/2015, Shri Govind Guru University was founded by the Gujarat government. The university is headquartered at Godhra, Panchmahal . The Panchmahals, Dahod, Mahisagar, Chhota Udaipur, and Vadodara (Rural) districts of the state of Gujarat are within the jurisdiction of the university. All of the colleges and institutions found in the aforementioned districts are connected to this university. Shri Govind Guru University now has 246 colleges as affiliates.

The New Administrative building of Shri Govind Guru University has been constructed at Vinzol, Dist., Godhra. With The vision of Hon’ ble Vice Chancellor, Prof PratapSinh Chauhan and under the guidance of Shri N.K Ojha, the administrative building has been built as a Green Building. The building's design

placed a strong emphasis on lowering energy consumption by offering enough natural light, shade, a cool landscape, and energy-efficient active building technologies.

Design Strategies:

In order to maintain good internal comfort, passive design refers to the specific approach to construct a structure employing the natural flow of heat and air, passive solar gain, and cooling. The usage of mechanical systems, energy consumption, and CO_2 emissions may all be eliminated, or at least much reduced, by the use of passive solutions.

Orientation:

The first basic principle of passive design strategies is orientation. The University Building is oriented in East to West side with distinct blocks joined by passageways and a vast centre court yard. Orientation minimizes heat ingress optimal window to wall ratio.

Landscaping:

The University is in process to develop forest through Miyawaki Forest technique with the help and guidance of Forest Department. The work has been started and is under progress.

Daylighting:

Central of building floor space is day lighted thus reducing dependency on artificial lighting in a day is less.

Ventilation:

Centre courtyard is open to sky(OTS) facilitates airflow as natural ventilation also cross ventilation is improved through windows and jaalis.

Materials and construction techniques :

- Permanent piping technology anti terminate treatment using lldp tube
- B.T. Stone Aggregates
- Common burnt clay building conventional type brick having crushing strength not less than 35 Kg./Sq.cm.
- Wall painting with premium acrylic emulsion paint having VOC (Volatile Organic Compound) content less than 50 grams/ litre

- EPDM gasket, 1.2 ± 0.2mm thick galvanised steel profile and mosquito net with hardware hinges
- Precast Rubber Dye inter locking concrete block 60mm thick with grade of concrete M-250 pneumatic
- Casting in situ controlled cement concrete M-200 for Kerb blocks
- GRC-glass reinforced concrete [The GRC should be made from '53 grade' cement manufactured by 'JK/Birla cement' or equivalent, quartz, fine silica sand, alkali resistant glass fibre manufactured by 'n.e.g. japan' or equivalent.].

3. Results

As results if construction is sustainable than total cost is increased by around 4,00,000 and compare to conventional there were around 5,00,000.if construction is sustainable and green than reducing water demand and efficient plumbing fixtures and fittings , energy conservation is more so reducing energy demand and also efficient HVAC system to decrees internal temperature, due to best indoor air quality so dependency on artificial light is less.

	Conventional construction	**Sustainable construction**
Window and fixtures	1,30,800	2,07,350
lighting fittings	12,800	46,150
Plumbing	44,885	1,08,300
Flooring	2,28,540	2,84,295
Door	69,830	1,62,510
Paint	1,56,380	1,58,880
Bricks	50,175	30,105
Cement	96,600	9,83,250
RWHS	0	80,700
Total	16,59,410	20,61,540

Table 2 cost comparison between conventional and sustainable construction

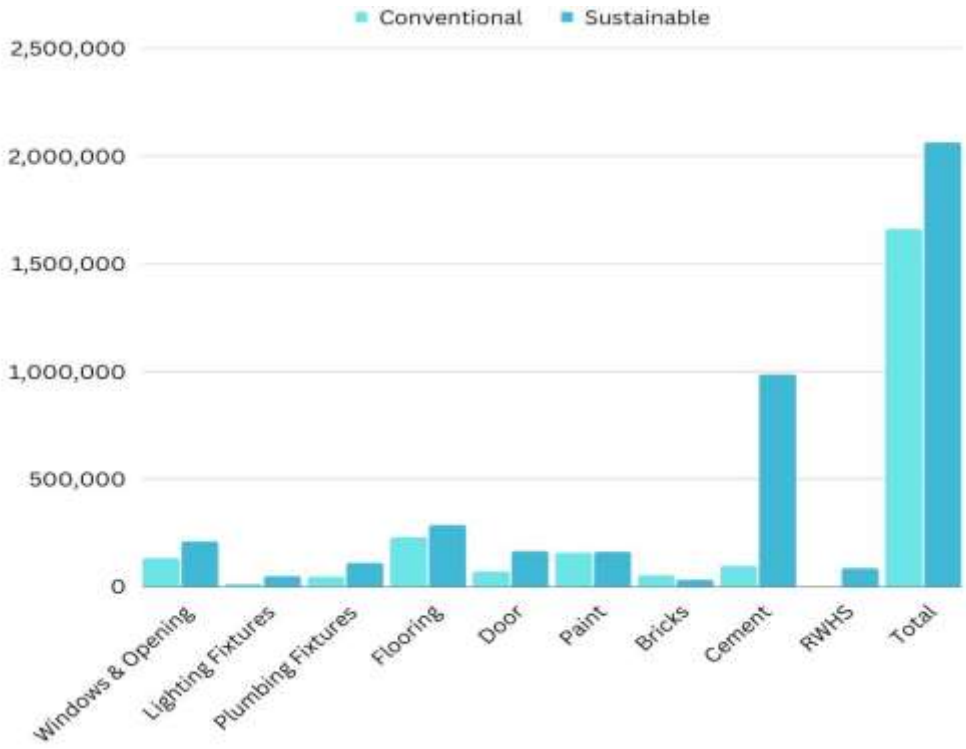

Fig 2 Cost comparison between conventional and sustainable construction

[Source: author]

4. Conclusion

Sustainability is important for the ecosystem and human life on the planet, and it should be the primary goal of all construction in the modern world. This can be accomplished by using proper management in construction practises, starting with material selection, moving through procurement, placement, and development to finishing and painting, and finally to performance and maintenance of the structure, including processes like recycling and dumping even after the structure has been demolished.

This research discussed about make construction sustainable and green as possible. As author conclude that sustainable construction Can be more expensive in the short term but more cost-effective over the long term as compare to convention construction may be less expensive in the short term but can be more costly in the long term due to higher operating costs.

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