Sustainable Construction System For Cost Effective Housing Solutions

Prajwal Paunkar
School of Engineering and Technology
G.H Raisoni University,Amravati

Abstract- *Low cost housing and alternative and innovative construction system are the different concept which deals with effective costing and following of techniques which help in reducing the cost of construction through the use of faraway available material beside with and technology improved skill without losing the power, performance and life of structure.*
Also construction sector requires paradigm shift from traditional construction systems by bringing innovative construction systems which are resource efficient, environmentally responsible, climate responsive, sustainable, disaster resilient, faster, structurally &functionally superior.There is huge misconception that low cost housing is suitable for only subnormal works and they are built by using cheap building material of low quality.

Cost of reduction is achieved by selection of more efficient material or by an improved design. Construction of low cost housing by using low cost construction material increases the access to building by low income group peoples. Advantage of low cost building material are pollution prevention, reducing energy consumption and use of natural materials, and reusability of building materials. Also, Indian construction sector needs to be receptive & innovative to adopt and adapt these systems to build New India leading to sustainable growth and quality living to its citizens.

Keywords- Low cost housing, Sustainable , Energy consumption.

I. INTRODUCTION

In the pursuit of a harmonious coexistence between humanity and the environment, the paradigm of construction has undergone a transformative shift towards sustainability. In the wake of burgeoning urbanization and the pressing need for affordable housing solutions, the discourse surrounding sustainable construction systems and materials has gained unprecedented significance. As we stand at the intersection of progress and environmental stewardship, the imperative to create cost- effective housing solutions that not only meet the immediate needs of a burgeoning global population but also safeguard the delicate balance of our ecosystems has never been more pronounced. The built environment, once considered an emblem of progress, has increasingly come under scrutiny for its ecological footprint and resource-intensive nature. In this context, sustainable construction emerges as a beacon of innovation, resilience, and responsibility. It represents a departure from the conventional practices that have, over the years, contributed to environmental degradation, resource depletion, and escalating costs. Instead, it propels us towards a future where housing solutions are not just shelters but conscientious expressions of our commitment to the planet's well-being. Sustainable construction encompasses a holistic approach that addresses various facets of the building process – from the selection of materials to the implementation of energy-efficient systems and the integration of environmentally conscious design principles. At the heart of this paradigm shift lies the understanding that the built environment should not be a burden on the ecosystem but rather a testament to human ingenuity coalescing with the natural world. Moreover, as the global population continues its upward trajectory, the demand for housing solutions has reached a crescendo, underscoring the urgent need to find economically viable alternatives that do not compromise on quality, safety, or sustainability. Low cost housing can be considered affordable for low and moderate-income earner if household can acquire a housing unit for an amount up to 30% of its household income. In developing countries such as India, only 20% of total population are high income earners, who are able to afford normal housing units. The low-income groups in developing countries are generally unable to access the housing market. Cost effective housing is an relative concept and has more to do with budgeting and seek to reduce the construction cost through better management appropriate use of innovative construction system, materials, skills and technologies but without sacrificing the performance and structure life.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

The Project aimed to improve alternative and innovative construction system and House is one of the biggest need and low-cost housing gives the houses to people at reasonable rate. Pursuant to this, following objectives are proposed in the present investigation.

- To study different types of construction materials and alternative and innovative construction system and technique used, to reduce the cost of construction and innovate construction system.
- Alternate and low-cost construction materials and techniques used for sustainable development.
- Provide exposure to executed projects where such materials and technologies have been implemented.
- Familiarize the professionals with the latest materials and technologies being used worldwide for housing.
- Usage of local building materials, local skills and environment-friendly options.
- To encourage and promote the use of innovative technologies as an alternative to traditional housing construction system.

Necessity of alternate and innovative Construction systems

1. Resource Efficiency

A conventional building tends to focus on the use of basic materials namely cement, bricks, sand, aggregates, steel which are based on natural resources. Also, there is over dependence on fossil fuels for production & transportation. These natural resources are finite and cannot be replenished quickly. Also, their extraction and manufacturing have direct and indirect consequence on environment requirements and pose danger to our planet in terms of greenhouse gas emissions, land & air pollution etc. Therefore, natural resources are to bused efficiently which is one of the key features of alternate construction systems as they employ industrial techniques to produces building components and use cement, steel and other aggregates optimally. The other feature of alternate construction systems is to make use of renewable resources.

2.Structural Design Efficiency

The alternate systems follow the path of optimization. Right from the concept & design stage, the building components including structural configuration is designed in a manner to optimize the performance. The performance-based design instead of prescriptive design philosophy is the key for design efficiency while dealing with these alternate construction systems.

3. Disaster Resilience

The alternate construction systems designed to be resilient in terms of natural hazards as it entails performance-based design of buildings.

4. Energy Efficiency

Alternate construction systems often include measures to reduce energy consumption i.e. the embodied energy required to extract, process, transport and install building materials and the operating energy to provide services such as heating and power for equipment. The buildings with alternate systems use less operating energy, embodied energy. These buildings will have a lower embodied energy than those built primarily with brick, mortar, concrete, or steel.

5. Water Efficiency

The conventional construction systems primarily are cast-in-situ reinforced concrete systems which require large quantity of potable water for curing and most of the time, the water of curing go waste. The new systems employ better techniques of curing such as pressurized curing, chemical curing etc. which help in conserving the water during construction.

6. Operation & Maintenance Optimization

The construction systems identified are based on factory made building components which are manufactured with high precision under strict quality control and therefore, more durable requiring no or minimum maintenance. The alternate technologies are industrial products having SOPs for building's O & M.

WRITEDOWNYOURSTUDIESAND FINDINGS

The global push for sustainability in construction has led to the development of various innovative systems that are superior to traditional RCC/load-bearing methods. These alternatives include filler slabs, which reduce concrete usage by incorporating low-cost filler materials; rat trap bond masonry, offering cost and material savings with improved thermal efficiency; and GFRG panels, which cut construction costs and carbon emissions. Engineered formwork systems, including aluminium and tunnel forms, accelerate construction and improve quality. Insulated concrete forms and sandwich panel systems enhance energy efficiency and durability. Structural steel frames and precast concrete, including 3D volumetric and hollow core slab construction, provide robust, rapid, and sustainable building solutions. These methods collectively offer faster, safer, and environmentally friendly housing with better performance.

Cost-effective materials for housing include bamboo-reinforced columns and beams, fly ash bricks, rice husk ash bricks, straw bale bricks, stabilized mud blocks, gypsum

plaster, and copper slag plastering. Bamboo offers high tensile strength comparable to mild steel, making it an excellent steel substitute. Fly ash bricks are lighter and stronger than clay bricks, providing thermal benefits and reducing mortar usage. Rice husk ash enhances brick compressive strength, while straw bales offer lightweight, thermally efficient building options. Stabilized mud blocks reduce energy consumption and costs, and gypsum plaster eliminates the need for water curing, addressing sand scarcity. Copper slag can partially replace sand in cement mortar, offering sustainable plastering solutions. These materials collectively enhance sustainability and affordability in construction.

III. CONCLUSION

Good housing is a need to every human being. Everyone wants to live in big houses which are comfortable. In urban areas there is a shortage of number of houses. People need houses that are attractive, having more life span, larger space area, environmental friendly and cheaper. Therefore, cost effective houses and low cost houses are needed to fulfil the demand. The local available materials and technology serve a purpose for low income people. Using cost effective technology will not only save money but also reduce CO2 emission, save time and faster production. A cost reduction of 20-30% can be achieved by using alternative methods.

- Benefits with Alternate Construction Systems are Improved structural & functional performance, Safer and disaster-resilient house, Better quality of construction, Low maintenance, minimum life cycle cost.
- •It is necessary to adopt cost effective, innovative and environment friendly housing technologies for construction.
- •This study examined the cost effective and environment friendly , Better fire resistance & thermal efficiency , Less air pollution and waste generation.
- •This study examined the cost effectiveness of using low cost housing technologies in comparison with traditional construction method.

REFERENCES

[1] P.Bhattarai,“Straw Balein Building Construction and Its Future in India,” International Journal for Modern Engineering Research, Vol. 2,No.2, 2012, pp.422-426.
[2] A. L. Moslemi, “Technology and Market Consideration for Fiber Cement Composite,”11thInternational In organic Bonded Fiber Composite Conference, Madrid,4-7November 2008.
[3] Shankar C, Vishwajeet S , Gaurav T , Rooman I, Milind. M. D,"A review study on ASurvey on Alternative Low Cost Construction Materials & Techniques"Int. Res. J. Eng.Technol,4(4), 2319-8753.
[4] Dogne, Nitesh, and Ashish Choudhary. "Smart Construction materials and techniques."In AICMT: National Conference ON Alternative & Innovation Construction materialsand Techniques.2017.
[5] Study and determination of cost indices in projects in India by Vaid K.NNICMAR publication -1997.
[6] Bubshait,B.A.A.,Member,A.,&Al-musaid, A.A.(1992). Owner involvement in construction projects.
[7] Jasvi, Ali Haider, and D. K. Bera. "Sustainable use of low cost building materials in the rural India." International Journal of Research in Engineering and Technology 4 (2015):2319-1163.