

A Review Study on Cost – Effective Construction Methods In Housing Sector

Stephen samuvel P¹, Nithishkanna P¹, Dayanand R¹, Surendran S¹

Undergraduate student , Bachelor of Architecture

Professor : Dr. Alan sekaran², Ar. Shivachandran²

Faculty of Architecture , Design and Planning , Karpagam Academy of Higher Education , Coimbatore
Tamil Nadu , India.

Abstract - Rapid urban growth has increased the demand for affordable housing, especially for people belonging to the economically weaker section (EWS) many families struggle to obtain a house due to high construction costs and limited financial resources. Low cost house aims to provide practical and affordable living space by adopting efficient planning and economical materials. Technique such as modular planning and reducing material wastages, decrease construction expenses. In addition incorporating passive design strategies like natural lighting and ventilation can improve comfort while lowering energy consumption. Therefore a thoughtful design, careful material selection , and cost effective construction methods can help create accessible housing solution for communities with limited income while supporting long term environmental and social sustainability.

Key Words: Low-Cost Housing , Time Management , Alternative Building Materials and Labour Management .

1. INTRODUCTION

Everyone in the low income group deserves safe and affordable house. This study explores practical way to lower the building cost by using affordable materials and simple efficient construction techniques. Special focus to lower cost materials like fly ash bricks , cseb bricks or some other earthen construction techniques. At the same time, these materials also support environmental friendly construction practices. Proper Planning and careful execution is an effective solution to address the growing housing demands of economically weaker section communities.

Housing is one of the most basic human needs and plays an important role in improving the quality of life and social stability of people in developing countries like India . Rapid population growth and urbanization have increased the demand for housing, especially for people belonging to the economically weaker section. Due to migration from rural areas to cities for employment, education and better living conditions, the housing demand in urban areas increased significantly. However ,

many people cannot afford standard housing due to high construction cost and land cost. Low cost housing has become an inevitable solution to address the growing housing shortage. It focuses on reducing the overall cost of construction while maintaining structural safety, durability and acceptable living standards.

This can be achieved through efficient cost management, proper project planning and the use of innovative construction techniques. The use of locally available building technologies can significantly reduce construction expenses. Low cost housing is a concept which deals with effective budgeting and following of technologies which helps reducing construction cost through the use of locally available materials along with improved skills and technologies. Especially in developing countries like India nearly one third of India's population currently lives in urban areas, this proportion is expected to increase to about 40% by 2030(Effective Budgeting and Low Cost Housing 2017 - T. Navya and P.V.S. Koteswara Rao).

LITERATURE REVIEW:

1) A.K KASTHURBA ET. AL (2014)

This paper discusses the use of Laterite as a sustainable building material and highlights its benefits as of a locally available and cheap material as compared to the conventional modern materials. The attempt is to develop standards for use of Laterite in building applications. The use of Laterite is marginalized because of the lack of standardization and the difficulty in conducting various testing procedures. Standard size laterites of 390x190x190 mm were taken for experimenting and testing procedures for determining its various engineering properties which implied the need for development of a suitable classification since the test sample had shown large variation in strength but, for residential uses it is sufficient and the minimum strength requirement should be reconsidered.

2)B.V.V. REDDY (2011)

This paper had studied the suitability of manufactured sand as fine aggregate material. In this study the characteristics of concrete and mortar using M-sand as fine

aggregate were determined and compared with that of concrete with river sand. The mortar made with M-sand showed better engineering properties (compressive strength, better workability, bulk density etc.) as compared to that with river sand. The concrete sample was of M20 & M30 grade which gave very satisfactory results when M-sand was used in place of river sand. Hence the test program gave a positive aspect on the suitability of M-sand as an alternative to river sand and also helps in the cost reduction for constructional activities are unavoidable.

3) M.M. ELDHOSE ET. AL (OCTOBER 2014)

This paper investigated the physical properties of GFRG Panel and the suitability of various suitable filler materials with the help of various experiments. The Physical properties of GFRG panels such as water absorption, compressive strength and flexural strength were investigated and results were obtained. The compressive strength was also tested by using 3 types of filler materials (Nominal mix-M25, Flyash concrete and Recycled aggregate concrete) which provided with 3 different values. The results from various tests implied that filler materials increases the compressive strength of GFRG panels and Recycled aggregate concrete as a filler material gave satisfactory results. Hence, it can be concluded that GFRG panels with suitable filler material can be used efficiently as a low cost construction technique

4) R.K. WATILE ET. AL (MAY 2014)

This paper had obtained result of the various properties of interlocking blocks through an experimental effort. The effect of GFRP with maximum percentage of fly ash in interlocking bricks is studied. Materials used for the casting of brick were cement, fly ash, stone-dust, GFRP, fine aggregate and water which were mixed in varying proportions and blocks of size 230 x 100 x 75mm are obtained and were tested for different values of compressive strength and it was noted that the compressive strength of any individual block shouldn't fall under the minimum average compressive strength by more than 20%. The study showed that the water absorption of the bricks is directly proportional to the fly ash content used and the strength of interlocking bricks increases with increasing fly ash time to time. Interlocking bricks have sufficient strength and are extremely suitable for low cost housing and non-load bearing structures

5) BREDENOORD J

This research emphasizes the concept of sustainable housing that extends beyond just materials. It highlights the importance of employing sustainable building materials alongside community development measures. This holistic approach fosters long-term success by

considering the social and environmental needs of residents. Environmental Benefits of Earth Construction Pachecotorgal's research: This study explores earth construction as a sustainable building approach. It highlights the environmental benefits of using earth materials compared to conventional techniques. These benefits include reduced resource consumption, improved indoor air quality, and potentially lower embodied energy.

6) ALTERNATIVE MATERIALS AND TECHNOLOGIES R. CAPONETTO

This study explores the potential of ecological materials (recyclable and natural) and technologies in low-cost building systems. Caponetto emphasizes the environmental benefits of using recyclable materials, reducing the demand for virgin resources and promoting sustainability. Swaptik Chowdhury : This research investigates alternative construction materials for low-cost housing in India. It explores both natural materials (e.g., bamboo) and man-made materials (e.g., recycled plastic) as potential cost effective alternatives to traditional materials like fired bricks and concrete. Sengupta Nilanjan: This study focuses on identifying appropriate cost-effective building construction technologies. Nilanjan utilizes field surveys and technical calculations to evaluate various options. This approach provides a data driven basis for selecting the most suitable cost-effective technologies for a specific project.

7) SPECIFIC MATERIAL STUDIES:

J.M. Khatib and R. Siddique examined self- compacting cement fly ash concrete, highlighting its strength, workability, and potential for reducing labor costs. D. Manikandan and Dr. S. Gopalakrishnan studied autoclaved aerated concrete (AAC), emphasizing its advantages in reducing structural element sand improving wall bearing capacity, leading to faster construction and potentially lower costs. Dr. R.R Singh and Er Arpan Jot Singh Sidhu investigated high-volume fly ash concrete as a cost-effective and environmentally sustainable alternative, showcasing its potential for reducing cement usage without compromising concrete strength. This approach aligns with the goal of achieving both cost-effectiveness and environmental sustainability in construction practices

8) AR . J . JEBARAJ SAMUVEL (2015)

This studied various cost effective methods at different parts of a building. He achieved cost reduction by replacing conventional materials with alternative materials, proper designing approach, planning, and management of construction and with good construction skills. For foundation, he suggested the use of arch foundation which saves foundation expenses up to 40% Replacement of plinth slab by brick on edge can save 35-50% plinth cost. The use of rat trap bond wall achieves the

same strength as conventional 250mm wall but requires 20% less bricks. Replacement of wooden frames by concrete or steel frames can be done for achieving cost reduction up to 40%. Conventional RCC lintels cost 30-40% higher than brick arch lintels which can be used for smaller spans and for roofing, he suggested the use of filler slabs which is about 23% less costlier than conventional slab.

9) ALONE AND SAWANT (2014)

This paper used scorecard approach to assess the factors causing concrete waste in building construction and found that in India concrete waste makes around 4.7% part of total material (year-2012). Based on site observations, interviews & questionnaire survey a complete set of 50 factors, grouped in 5 categories was done. The value of waste index was calculated for each category and they found that project management, planning and methodology was the highest rated factor with waste index 227 followed by materials, machinery and equipment. This concluded that project management, planning and methodology is the factor causing highest influence to the generation of concrete waste and hence increasing construction costs.

10) JONES LANG LASALLE (2011)

The paper offers the concept concerning Urbanization and Housing shortage in Bharat as per EWS, LIG, MIG and HIG as per the technical cluster report on Estimation of Urban Housing .In this paper below the Policy Framework and rules for Low price Housing the Central level Schemes likewise as State sponsored initiatives area unit mentioned. Central level schemes like. statesman National renewal Mission (JNNURM) and Maharashtra Housing and space Development Authority (MHADA)

11) SWAPTIK CHOWDHURY, SANGEETA ROY,2013 :

This study shows “Prospects of Low- Cost Housing in India”, The paper presents work on low-cost and sustainable alternative building materials having advantages on areas such as India where concrete or steel housing is expensive. The project addresses the challenges and stereotypes of using these materials as a structural component for low-cost housing and their same capacity for adaptation to the broad spectrum of factors—physical, ecological, social, economic and technical—through different products developed which can be the production of the construction environment.

12) A. K. JAIN, M. C. PALIWAL,2012:

“Adoption of Appropriate and Cost-Effective Technologies in Housing: Indian Experience “There is a need to adopt cost-effective construction methods either by up-gradation of traditional technologies using local resources

or applying modern construction materials and techniques with efficient inputs leading to economic solutions. This has become the most relevant aspect in the context of the large volume of housing to be constructed in both rural and urban areas and the consideration of limitations in the availability of resources such as building materials and finance.

13) VIVIAN W. Y. TAM ET.AL., 2011 :

This paper offers “Cost Effectiveness of using Low Cost Technologies in Construction Housing” Case studies in India are used for the investigation. Construction methods of foundation, walling, roofing and lintel are compared. Strength and durability of the structure, stability, safety and mental satisfaction are factors that assume top priority during cost reduction. This proves that using low cost housing technologies is a cost-effective construction approach for the industry

14) SUNIL KUMAR (2002) :

This study shows the production of fly ash lime– gypsum bricks and hollow blocks to solve the problems of housing shortage and at the same time to build houses economically by utilizing industrial wastes and investigated the compressive strength, water absorption, density and durability of these bricks and hollow blocks. He observed that these bricks and hollow blocks have sufficient strength for their use in low cost housing development.

15) SENGUPTA NILANJAN & ROY SOUVANIC (2013)

This study shows the acceptability and adaptability potential of different Eco friendly Construction Technologies through field survey, literature study and technical calculations and tried to find out the most appropriate one among those. From the study and analysis concluded that Rat-trap bond wall and Filler Slab roof would be the most appropriate and acceptable CECT among people belonging to Middle Income Group and below in India as they are satisfying all their guiding criteria.

DISCUSSION AND SUGGESTION:

- **ALTERNATIVE AND SUSTAINABLE MATERIALS** such as laterite, M-sand, GFRG panels, fly ash concrete, AAC blocks, bamboo, and recycled aggregates plays a significant role in reducing construction costs while maintaining adequate structural performance. These materials not only lower dependency on conventional resources but also contribute to environmental sustainability by reducing embodied energy, waste generation, and resource depletion. However, the lack of

standardization and testing procedures, as observed in materials like laterite, remains a major challenge that needs to be addressed for wider adoption.

- **CONSTRUCTION TECHNOLOGIES** and methods such as interlocking blocks, rat-trap bond masonry, filler slabs, and arch foundations provide effective solutions for minimizing material consumption and cost without compromising strength and durability. These techniques also simplify construction processes, making them suitable for low-cost housing, especially in developing regions.
- **TIME AND LABOUR MANAGEMENT** emerge as critical factors influencing overall project cost. Efficient planning, proper scheduling, and adoption of technologies like prefabricated systems (e.g., GFRG panels) significantly reduce construction time and labour requirements. Studies also highlight that poor project management and methodology contribute heavily to material waste and increased costs, emphasizing the importance of systematic execution and skilled workforce utilization.

TABLE 1 : ANALYSIS OF COST OPTIMIZATION STRATEGIES IN LOW-COST HOUSING PROJECTS :

| S.NO | EFFECTIVE STRATEGIES | PERCENTAGE | OUTCOME |
|------|-----------------------|------------|----------|
| 1 | ALTERNATIVE MATERIALS | 18 % | MODERATE |
| 2 | SUSTAINABLE MATERIALS | 38 % | HIGH |
| 3 | TIME MANAGEMENT | 14% | HIGH |
| 4 | LABOUR MANAGEMENT | 15% | MODERATE |
| 5 | OTHERS | 15 % | LOW |

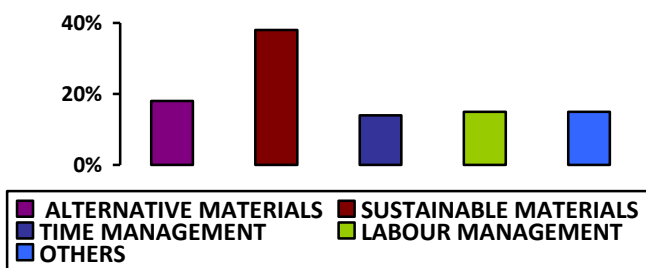


CHART 1 : ANALYSIS OF COST OPTIMIZATION STRATEGIES IN LOW-COST HOUSING PROJECTS :

CONCLUSION:

The reviewed studies collectively demonstrate that achieving low-cost construction is not dependent on a single factor, but rather on an integrated approach involving material innovation, sustainable practices, and efficient management strategies. The collective findings from the reviewed literature indicate that low-cost construction is best achieved through a balanced integration of material efficiency, technological innovation, and management practices, rather than relying solely on cheaper materials. While alternative materials such as laterite, fly ash concrete, M-sand, GFRG panels, and AAC blocks show promising results in reducing cost and environmental impact, their performance often varies due to inconsistencies in quality, availability, and lack of standardized guidelines. This highlights the need for further research and codification to ensure reliability and wider acceptance in mainstream construction.

REFERENCE:

- (1) Kasthurba, Krishna R Reddy, Venkat Reddy, Use of Laterite as a sustainable building material in developing countries, International Journal of Earth Sciences and Engineering, vol. 7 issue 4, August 2014, pp. 1251-1258.
- (2) B.V.V Reddy, Suitability of M-Sand as fine aggregate in mortars and concrete, CSIC project: CP 6597/0505/11-330 date 5th July 2011. Jones Lang LaSalle (2012) 'Affordable Housing in India: An inclusive Approach to Sheltering the Bottom of the Pyramid', On Point, pp. 1-20. Available at: <http://mhfcindia.com/Affordable Housing India-1.pdf>.
- (3) M.M.Eldhose Basil P Alias, Biji K Eldhose, Sarath Rajan, Thasneem Hussain, Study of GFRG Panel and Its Strengthening, International Journal of Civil and Structural Engineering Research, Vol. 2, Issue 2, pp: (161-165), Month: October 2014 - March 2015.
- (4) R.K.Watile, Deshmukh, Muley, Interlocking Brick for Sustainable Housing Development, IISBT Vol.2 (No. 2), May 2014, pp.58-64.
- (5) Bredenoord, J. (Year not provided). Sustainable Housing and Community Development: A Holistic Approach. Journal of Sustainable Development, 12^ * (3) 210-225.
- (6) Caponetto, R. (Year not provided). Ecological Materials and Technologies Low-Cost Building Systems. Journal of Sustainable Architecture, 8^ * (3) , 145-158.
- (7) SPECIFIC MATERIAL STUDIES : Singh, P. (Year not provided). Addressing Rising Construction Costs in India:

Strategies for Cost-Effective Construction Methods.

Journal of Construction Economics and Management, 25^(2) 112-125.

[8] Ar. J. Jebaraj Samuel, Cost effective methods used in various levels of a building, International Journal of Engineering Research and General Science Volume 3, Issue 6, November-December, 2015, pp. 850-854.

[9] Alone and Sawant, Scorecard approach to assess factors causing concrete waste in building construction projects, NICMAR October-December 2014 Vol. XXIX No. 04.

(10) Jones Lang LaSalle (2012) 'Affordable Housing in India: An inclusive Approach to Sheltering the Bottom of the Pyramid', On Point, pp. 1-20. Available at:

(11) Swaptik Chowdhury, Sangeeta Roy (2013), Prospects of Low Cost Housing in India, Geomaterials, 2013, 3, 60-65

(12) A. K. Jain, M. C. Paliwal (2012) Adoption of Appropriate and Cost Effective Technologies in Housing: Indian Experience International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering Vol:6, No:3, 2012 Page-304- 306

(13) W. Y. Tam (2011), Cost Effectiveness of using Low Cost Technologies in Construction Housing, The Twelfth East Asia-Pacific Conference on Structural Engineering and Construction, Procedia Engineering 14 (2011) 156-160

(14) Sunil Kumar, "A Perspective Study on Fly Ash-Lime Gypsum Bricks and Hollow Blocks for Low Cost Housing Development", ELSEVIER, Construction and Building Material 16, 519-525, 2002.

(15) Sengupta Nilanjan and Roy Souvanic, "Study of Appropriateness of Cost-Effective Construction Technologies in Housing Sector in India", JAET, Vol. 2, Issue 2, 2013.