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A Review on "To examine and compare filler slab technique and rat trap bond as an alternative low-cost construction technology"

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ABSTRACT

India is a developing country with only 20% of the highest paid group. Affordable housing can be considered affordable for a low- or middle-income person if the family can get a unit of housing for up to 30% of the family income. The low-income group of developing countries often do not have access to the housing market. Affordable housing is a related and closely related budget and seeks to reduce construction costs through better management, efficient use of local resources, skills and technologies without sacrificing the energy and health of the building. The "Rat Trap Mouse and Filler Slab" approach can be applied to a housing project to achieve cost effectiveness and structural stability without compromising the strength and durability of the system.In this project we work on Rat Trap Bond and Filler Slab Concept for alternative low-cost constructionmaterial.It was analyzed in thiscase study of Ajni in Nagpur district of Maharashtra.

KEYWORDS:-Filler Slab Technique, Rat Trap, Brick Masonry, Low Cost Construction Technology

1. INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

The affordable housing technology aims to reduce construction costs through other common methods and installations. "It is a budget and practical approach that helps to reduce construction costs through local resources and develop skills and technology without sacrificing the energy, efficiency and health of the building. 'Affordable housing' simply satisfies the low and basic human needs with a place to live and ignores other needs people crave to be home including the psychological, social, and aesthetic needs and ultimately, the need to make it real. All we need is for families to have a comfortable life and work in a sustainable environment. It is found that affordable and alternative construction technologies, which in addition to reducing construction costs by reducing the number of building materials through improved and innovative techniques, can play a significant role in providing better housing and environmental protection. This paper examined the effectiveness of the cost of using

affordable housing technology compared to traditional building methods.

In addition to the conventionally used materials there are various alternative technologies and materials developed by various research organizations, innovators and manufacturers in India that are beneficial in the housing construction. As part of this Information collected has been provided in the subsequent sections. Low cost Housing materials can be broadly classified into natural materials and manmade materials according to the source of the building materials.

In existing approach affordability is measured in terms of disposable income, In the context of housing, affordability means the financial capacity of an individual to buy or rent a house. In 2008, the High Level Task Force on Affordable Housing for All, setup by the Government of India, defined affordability as a measure of household gross annual income and the size of a housing unit. Itrecommended that for economically weaker section and low income groups, the suggested affordability is cost not exceeding four times of the household gross annual income and EMI/ rent not exceeding 30% of the household's gross monthly income for a unit with carpet area not exceeding 300 and 600 sq.ft. For middle income category of houses, the cost was recommended as five times the household gross annual income and EMI/ rent not exceeding 40%, for a prescribed carpet area not exceeding 1200 sq.ft. India is currently facing a shortage of about 17.6 million houses.

This project emphasises on the methods of using low cost housing technique in India. It provides us a challenge to use the natural materials and their by-product so as to reduce the wastage or bye products obtained from industries and environmental pollution.

1.2 OBJECTIVES OF THE PROJECT

- To examine the filler slab construction technique and rat trap brick masonry which is used to reduce the cost of construction.
- To compare the filler slab technique with conventional slab technique.
- Alternative & low-cost construction material & techniques used for sustainableDevelopment using Rat Trap Bond and Filler Slab.
- To identify total cost required to completing a project using conventional andCost-effective Technology.
- To compare cost & Time reduction by adopting different material & techniquesfor projects.

1.3 SCOPE OF THE PROJECT

The scope of the project is low-cost house designed and constructed as any other house with regard of foundation, structure and strength using Rat Trap Bond and Filler Slab. The reduction in cost is achieved through effective utilization of locally available building materials and techniques that are durable, economical, accepted by users and not requiring costly maintenance.

2. LITERATURE REVIEW

This study is based on literature and field survey. The focus of the study is to find out issues resulted from low cost house construction projects that affect the construction activities.

[1] Alternative Low Cost Construction Materials& Techniques

Sudesh Bharsakhale (2020), This paper deals with Affordability is measured in terms of disposable income, In the context of housing, affordability means the financial capacity of an individual to buy or rent a house. In 2008, the HighLevel Task Force on Affordable Housing for All, setup by the Government of India, defined affordability as a measure of household gross annual income and the size of a housing unit. In this project we work on Rat Trap Bond and Filler Slab Concept for alternative low cost construction material. The need of alternative building technologies and materials has arisen in the past few years. Fortunately, there are many such options available at our disposal which when used in suitable combinations can save huge amounts of money and hence can result in affordable construction costs. Filler slab technology is a simple and a very innovative technology for a slab construction. The reason why, concrete and steel are used together to construct RCC slab, is in their individual properties as separate building materials and their individual limitation. Concrete is good in taking compression and steel is good in tension. Thus RCC slab is a product which resists both compressions as well as tensile. One such building technique is the use of _RAT TRAP BOND' masonry. Contrary to other technologies, this amazing building technology is not new to us. RTB was first introduced in India in 1970, by renowned Architect Sir Laurie Baker. Since then, it has been used

in many Government buildings and small village panchayats. In this modern age, we have overlooked this extremely useful technology which, while providing the same strength to the walls also saves us time and labor and also material cost to the extent of about 23% when compared with a standard 230mm brick masonry wall. In this project we have outlined the importance of RTB technology along with the construction details and also provided some comparative calculations to highlight the savings that can be achieved against the conventional solid brickwork.

[2] COMPARISON OF PERFORMANCE OF RAT TRAP BRICK BONDWITH THE CONVENTIONAL BRICK BOND

Zeeshan Ullah, Abudullah Khan (2018), In this project; Energy efficiency and sustainability are the basic needs of modern era. In order to achieve this there are several building construction techniques and environment friendly materials have been introduced. But there is a need to use these techniques and material in a proper combination so that they could be adoptable and economical and play a vital rule in the improvement of energy efficiency and sustainability. One such building technique to save energy is the use of 'Rat Trap Bond'(RBT) masonry. Contrary to other technologies, this amazing building technology is not new. RTB was first introduced in 1970. Since then, it has been used in many buildings and small houses. In this modern age, we have overlooked this extremely useful technology which, while providing the same strength to the walls also saves us time and labor and also material cost to the extent of about 23% when compared with a standard brick masonry wall. In this research an attempt is made to compare the conventional brick bond wall and RTB brick wall. The cost, energy use and thermal comfort of a house is compared by using both types of brick bond wall. It is concluded that RTB brick wall performed very well in saving energy and reducing the electricity bill cost.

[3] Sustainable Low-Cost Housing using Cost Effective ConstructionTechnology "Rat Trap Bond Masonry" and "Filler Roof Slab" in Bihar

Subha Sinha, Shivangi Mishra, Pallav Kumar, Shashank Saurabh (2020), In this paper; India is the developing country having only 20% population of higher income group. 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. The low-income group in developing country are generally unable to access the housing market. Low cost housing is a relative concept and has more to do with budgeting and seeks to reduces construction cost through better management, appropriate use of local materials, skills and technology without sacrificing strength and life of structure. The methodology "Rat Trap Bond and Filler Slab" can be used in housing project to achieve cost effectiveness as well as sustainability of the structure without compromising the strength and durability of the scheme. It was analyzed in this case study of Bihiya in Bhojpur district of Bihar, that was about 26.11% and 22.68% of the construction cost, including material and labor cost, can be saved by using Rat trap bond Masonry and Filler Slab respectively. The Rat Trap Bond Masonry creates heat insulation due to presence of air in cavity and inner side of the houses are warmer in winter and cooler in summer season as compared to external atmosphere. The methodology "Rat Trap Bond and Filler Slab" reduces the dead load of the structure and suitable for soils of low bearing capacity. In this methodology the locally available materials like earthen pottery, earthen tiles etc. which is conveniently available. The use of these methodologies gives the ornamental and architectural view of buildings which is looking attractive as compared to conventional methodology.

[4] Cost Effective House by Using Various Construction Techniques and Materials

U.J Pathak, C.S Chavan, Lalit Rathod (2014),Low cost housing technologies aim to cut down construction cost by using alternatives to conventional methods and Input. "It is effective budgeting and technique which help in reducing cost of construction through use locally available material along with improve skills and technology without sacrificing the strength, performance and life of structure. ''Low cost housing merely satisfies the most bottom and fundamental human needs for shelter and neglects other needs that people aspire home including psychological, social, and aesthetic needs and ultimately, need for self actualization. This paper examined the cost effectiveness of using low cost housing technologies in comparison with the traditional construction methods.

Two case studies in India were conducted. It was found that about 26.11% and 22.68% of the construction cost, including material and labor cost, can be saved by using the low cost housing technologies in comparison with traditional construction methods for walling and roofing respectively.

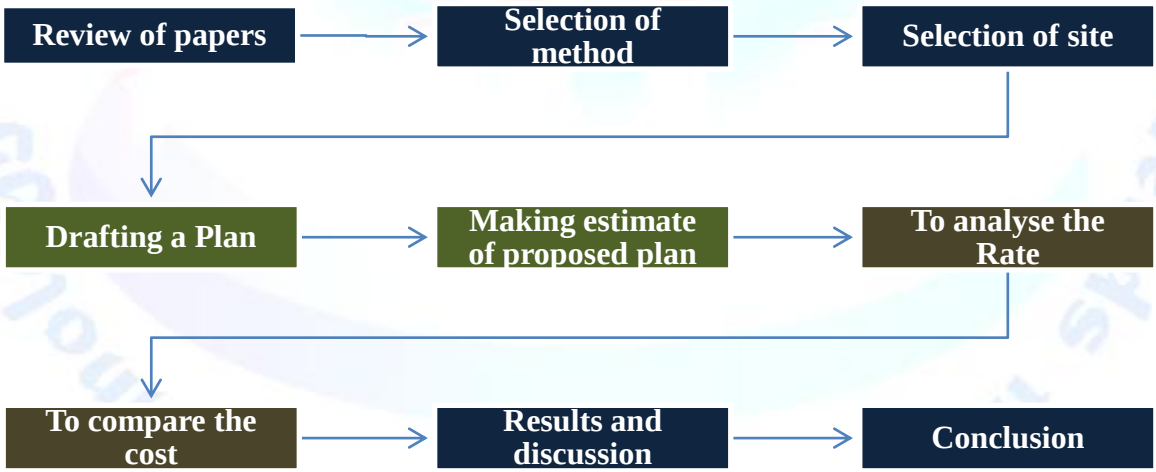
[5] SUSTAINABLE USE OF LOW COST BUILDING MATERIALS IN THERURAL INDIA

Ali Haider Jasvi, D.K. Bera (2015), This paper emphasises on the methods of using low cost housing technique in India. It provides us a challenge to use the natural materials and their by-product so as to reduce the wastage or bye products obtained from industries and environmental pollution. Various natural materials with their property, advantages disadvantages, and their availability have been discussed. The main challenge is to use the materials in structural component for low cost housing and their adaptation to factors like – technical, social, ecological, physical – through different products. It encounters the idea about the need of housing in rural India and explains different uses of materials and the techniques of building construction for LIG people, urban poor's in different aspects of building. It covers the use of local materials in the different components of building to make the building low cost and it makes an affordable houses for low income people.

3. PROPOSEED METHODOLOGY

The field study is divided into three parts –

- On site observation on construction activities to investigate and examine construction activities carried out by the contractors. Finding new construction techniques to implement them in construction of building.
- Study of low cost construction materials from projects under construction and recently completed. After completion of these processes, site observations will carried out to gather primary data. This data will help to determine the research basis and direction. Reviews of other works from literature survey will become the backbone of this research.
- Comparison of low cost building with conventional building.



3.1 SITE SELECTION

After deciding the Title of the project, I started searching for a suitable place as a live example for my project work for where I can make plan of house. Found a kutcha house at New Babulkheda ,AJNI a slum comes under the NAGPUR MUNICIPAL CORPORATION found suitable for my project due to the following reasons :

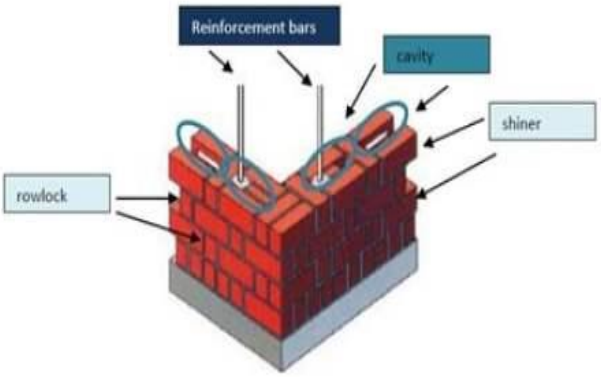
- The houses in this area are mainly kutcha houses i.e. without slab or brick walls.
- The alignment of the houses are in the improper way due to poor road condition which leads to improper use of land mass.
- The kutcha houses in this area are about 50-60 years old.

3.2 DESIGN TECHNIQUE

1. Rat-trap Bond Technology

Rat trap bond is a brick masonry method of wall construction, in which bricks are placed in vertical position instead of conventional horizontal position and thus creating a cavity (hollow space) within the wall.

The purpose of using this type of masonry bond is to reduce the number of bricks and mortar required as compared to the English/Flemish bond because of the cavity formed in the wall.



[Fig.1: Rat trap Bond Technology]

Table 1: The material strength requirement Rat Trap Bond

Type of Construction	Recommended Compressive Strength of Bricks Best Practice Minimum Allowable	Recommended Mortar Ratio
Load bearing, Double storied	40 - 50 kg/cm²	1:5
Load bearing, Single storied	35 - 40 kg/ cm²	1:4
Infill masonry in frame structure, no restriction on number of floors	Min 35 kg/ cm²	Not less than 1:4

Advantages of Rat Trap Bond-

1. The cavities in the masonry act as thermal insulators. Thus, the interiors remain cooler in summer and warmer in winter.
2. Rat Trap masonry uses fewer bricks and mortar reducing the cost of masonry up to 30% when compared with conventional brick masonry.
3. The number of bricks used in the construction of rat trap masonry is 470, whereas, in conventional masonry, it is 550.
4. Walls constructed using rat trap masonry can be used as load-bearing as well as a thick partition wall.
5. Rat-trap bond when kept exposed, creates aesthetically pleasing wall surface and the cost of plastering and painting may also be avoided.
6. As this type of masonry has 30% of cavities, the dead load of the structure is reduced which in turn reduces the structure supporting members such as column and footing.
7. In case of more structural safety, reinforcement bars can be inserted through the cavity until the foundation.
8. Many buildings that were constructed decades ago have proved that this type of walling technology is durable and the maintenance costs are low.

Disadvantages of Rat Trap Bond-

1. Due to the formation of cavities in the masonry, the building does not provide good sound insulations.
2. Skilled labor is required to construct this type of masonry.
3. Frequent cleaning of external surface required if not plastered.
4. Special care and attention to be given while designing and constructing rat trap bond masonry.

2. Filler Slab Technology

Filler slab technology is an innovative and cost effective technology where the dead load of slab is reduced by replacing the concrete with filler material.The filler slab is a slab construction technology, in which filler material part of concrete in the bottom of the slab is replaced, and as compared to reinforced cement concrete slabs it consumes less concrete and steel.

Filler slab is based on the concrete portions and instead of placing filler material there and is one cost-effective roofing system. Due to the use of low-cost, less-heavy filler material such as clay pots, rejected Cali-cut tiles, and broken pieces of cement blocks, the filler slab consumes less concrete and steel as compared to conventional RCC slab.

[Fig.2: Filler slab technology]

There are the following points to be kept in mind material selection for filler slab;

- With concrete or steel in the RCC slab constructed the filler material should not react and in nature, it should be inert.
- As it will soak the hydration water from concrete so filler materials water absorption should be checked.
- In weight filler material should be light so the dead load onto the foundations is reduced and the overall weight of the slab reduces.
- The cost of filler material is much lesser than the cost of the concrete it replaces so filler material should be of low cost.
- As not to provide an ugly ceiling pattern filler material texture should match with the desired ceiling finish requirements.

There are many advantages of filler slabs like the introduction of a less heavy, low-cost filler material it consumes less concrete and steel and reduced the weight of the slab.

4. CONCLUSION

Housing is a basic need and a right of all people. During our years, due to the huge rise in the real estate market rates, the dream of the average middle class and the low-income group remains a dream come true, as the reality of inefficiency is very painful. In this project we are working on the Rat Trap Bond and the Filler Slab Concept alternativeless expensive building material. Many attempts at government level have failed to alleviate the problemsthe housing shortage of ordinary people continues to grow at an alarming rate. Filler slab technology is simple and the newest slab construction technology. The reason why, concrete and steel are used together to build. The RCC slab, is located in each of them as different building materials and their individual boundaries. Concreteit is good for taking stress and iron is good for stress. The RCC slab is therefore a product of both pressures asand durability. The shortage we see today is not about housing itself, it is actually about `Affordable Housing.Fortunately enough, the solution to the shortage of affordable housing (especially in urban areas) can be achieved. We can notcontrol inflation, but Try to reduce construction costs with a simple switch,inexpensive building materials and technology. One such solution is the use of the Rat-Trap Bond Masonry Technique.The construction cost, including material and labor cost, can be saved by using the low-cost housing technologies by using Rat trap bond Masonry and Filler Slab respectively if we compare it with traditional construction methods for walling and roofing respectively.

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Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Ali Haider Jasvi, D.K. Bera, "SUSTAINABLE USE OF LOW COST BUILDING MATERIALS IN THE RURAL INDIA", Volume: 04 Special Issue: 13 | ICISE-2015 | Dec-2015, Available @ http://www.ijret.org

[2] Ayush Srivastava1 (2014) , Cost Effective and Innovative Housing Technology , IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 06, 2014 | ISSN (online): 2321-0613 , Page: 27-29

[3] S.Deepak ,V.A.Shanmugavelu(2014) , Cost Effective Techniques Uses In Modern Construction Projects ,IJSR - International

journal of scientific research,Volume : 3 | Issue : 5 | May 2014 • ISSN No 2277 – 8179, Page:169- 170

[4] Sudesh Bharsakhale, "Alternative Low Cost Construction Materials & Techniques", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 9, Issue 1, January 2020.

[5] Subha Sinha, Shivangi Mishra, Pallav Kumar, Shashank Saurabh, "Sustainable Low-Cost Housing using Cost Effective Construction Technology "Rat Trap Bond Masonry" and "Filler Roof Slab" in Bihar", International Journal of Engineering Research and Technology. ISSN 0974-3154, Volume 13, Number 7 (2020), pp. 1780-1785

[6] R.R.Sorate et al. (2014)Slum Rehabilitation with Fast Track Techniques,IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,pISSN: 2320-334X, Volume 11, Issue 3 Ver. VIII (MayJun. 2014), PP 27-32

[7] Zeeshan Ullah, Abudullah Khan, "COMPARISON OF PERFORMANCE OF RAT TRAP BRICK BOND WITH THE CONVENTIONAL BRICK BOND", 1st International Conference on High Performance Energy Efficient Buildings and Homes (HPEEBH 2018) August 1-2, 2018, Lahore, Pakistan.

[8] U.J Pathak, C.S Chavan, Lalit Rathod, "Cost Effective House by Using Various Construction Techniques and Materials", INDIAN JOURNAL OF APPLIED RESEARCH, Volume : 4 | Issue : 4 | Apr 2014 | ISSN - 2249-555X