

# Study on Low Cost Housing with Roof Top Rainwater Harvesting

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**Abstract-** The concept of low cost housing, through of recent origin has gained much success due to its practical utility in addressing the issue faced by rural people across the nation this concept adopted of eco-friendly technology and enterprise development based on less cost resources and it can be use as a total in addressing the issue of sustainable livelihood and food security. It provide the poor access to multiple sources of livelihood through skill up gradation and technological empowerment. This report tries to highlight some of the Morden day technologies that can be undertaken for the development of villages in India which are carefully chosen keeping in mind the inherent strength like materials, cost and efficiency. The technologies considered in detail here are the rat trap bond and filler slab .these technologies, if adopted while developing villages, would help to do away with the financial problem to a great extent. In India rural housing is provided through Pradhan Mantri Awaas Yojana a welfare program of the government of India. it was first implemented in 1996 as Indira Gandhi Awaas Yojana and its aim is “housing for all” by 2022. A recent interest in rural housing and roof top rainwater harvesting has emphasised the importance of linking its development with productive use of natural resources and poverty reduction. Rainwater harvesting system, also called rainwater collection system technology that collects and stores rainwater for human use. This system can supply households and businesses with water for use in dry seasons. The Main source of rooftop rain water harvesting is to make water available for future use. This system is use to Capturing and storing rain water for use is particularly important in dry land, hilly, urban and coastal areas. In alluvial areas energy saving for 1m. It around rise in ground water level 0.40 kilo watt per hour.

**Index terms-** Low Cost Housing Construction, Affordable Housing, Rural Housing for the Poor,

**Rooftop Rainwater Harvesting, Potable Water Saving, Ground Water Recharge**

## I. INTRODUCTION

One of the basic necessities for a human being is house or shelter. People within a specified income range cannot afford their own house and living on rental basis. Housing availability and various difficulties arising due to it is more critical in rural areas as compare to the urban areas. This can be understood from the data given by NSSO (National Sample Survey Organization) from the 69 round conducted in July 12 to December 12 which revealed that 61.1% of the urban population reside in their own houses and other 35.4% in rented homes whereas in rural areas 93.3% of the population had own houses and near 5.1% where residing on rental basis. The low cost housing can be solution for these problems in low cost housing the use of various low cost material and by replacing conventional technique which reduce the overall construction cost, improved skills and technology without sacrificing the strength performance and the life of the structure. 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. One such building technique is the use of ‘RAT TRAP BOND’ masonry and filler slab method.

## II. RELATED WORK

The village where we are performing our project is named as 'Takli' its near about 5-6 kms away from wanadongri.

Basic information about the village as per data given by Gat Gram panchayat (Sukali) :-

- Population-303
- Houses-50
- Water source-hand pump
- Hand pump-3
- "GHARKUL SCHEME" are made by 30 no of houses



Fig[1] :- The present village scenario

1) Problem identification:

1. Type of Houses :

The maximum numbers of houses in the village are kaccha houses i.e. without slab or brick walls.

2. Poor Infrastructure :

The alignments of the houses are in the improper way due to poor road condition which leads to improper use of land mass.

3. Road Condition :

The proper cement or bituminous roads in the village are still not present. During rainy days, these roads become a wet land affecting in the walking and travelling of the villagers.

4. Scarcity of Water during Summer :

The villagers face heavy scarcity of water during summer. Instead they have a water body (river) near the village, the villagers gets problem in drinking water and potable water as well

2)Survey

- Condition of Houses.
- Improper village infrastructure.
- Bad conditions of Road
- Improper Sanitation System.
- Water Scarcity.

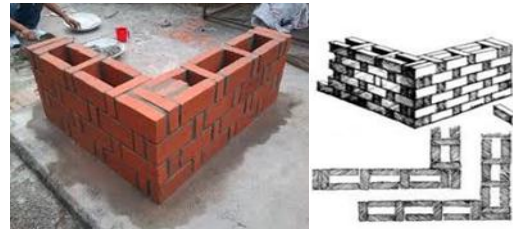
- We get lack of knowledge towards Construction of Houses.
- Lack of knowledge towards Schemes and Subsidies for Rural Areas.

3)Methods of resolving problems

- To plan and design proper infrastructure.
- To design W C and Bath.
- To design percolation tank.
- Engineering techniques is use to plan low cost housing

III. METHODS

1) Rat-Trap Bond:- The rat trap bond masonry is introduced by architect Laurie Baker in 1970s this technique is used to reduce construction cost, in this technique where the bricks are placed vertically at edge forming the inner and outer face of the wall which creates a cavity within the wall, while maintaining the same wall thickness as for a conventional brick masonry wall. While in a conventional bond, bricks are laid flat. The main advantage of Rat-trap bond is uses of bricks and mortar reduce the cost up to 30% as compare to conventional bond because of the cavity formed in the wall. The cavity also makes the wall more thermally efficient. This also reduces the embodied energy of brick masonry by saving number of bricks and the cement-sand mortar. It is suitable for use, wherever one-brick thick wall is required.



Fig[2];- Rat-Trap Bond

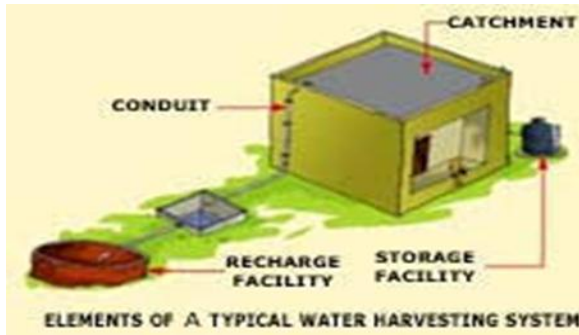
3) Filler Slab:- Filler slab technology is used by architect Laurie Baker in kerla extensively for reducing the constitution cost. This is a simple and a very innovative technology for a slab construction. The main reason of using filler slab is because the uses of concrete and reinforcement reduce construction cost up to 30% and reduce the dead load of slab which makes it light in weight as compared to conventional slab. By using this technique the filler materials are placed to maintain the strength of slab

without any compromise. By providing the internal cavity between the filler material adds an extra advantage; other than cost savings and energy savings and improved thermal comfort for the interiors.



Fig[4]:- Filler Slab

4) Rainwater Harvesting: - INDIA has a long tradition of water harvesting. The rainwater harvesting is the activity of direct collection of rainwater, which can be store for direct use or can be recharged into the ground water for increasing ground water table. Water harvesting means collection of rain water from the top of building roof, open spaces surrounding the buildings, farm area, etc. A study was planned to design a percolation pit to harvest rain water and recharge ground water aquifers so as to improve or maintain the ground water quantity. Therefore, most of the farms suffer from deteriorating soil health, receding water table. The stud was planned to design percolation pit to vertically drain the stagnated water during monsoon and harvest rain water for improving the ground water quality. It is clear that all possible approaches must be tried to minimize the problem of drinking water. Recharge can help move excess salts in the root zone to deeper soil into the groundwater system. It is simple technique to recharge is to dig a pit in the ground and make a filtering system so that clean rain water can reach underground and can be reused.

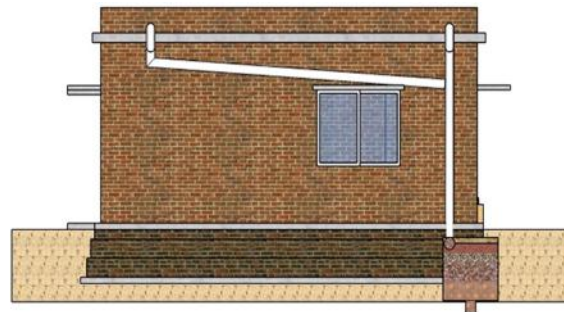


Fig[6]

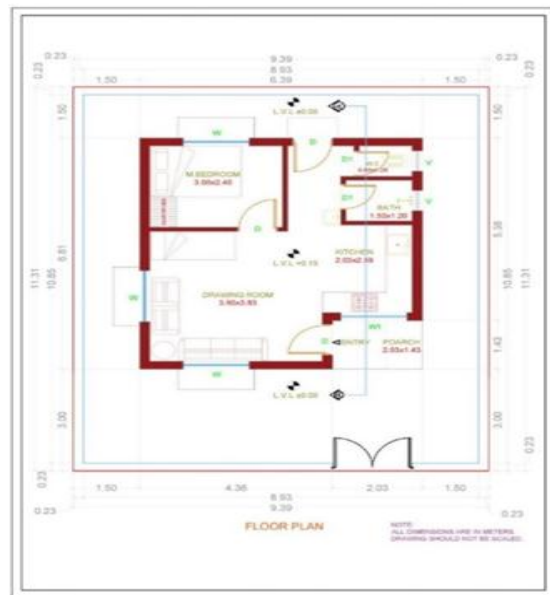
#### IV. DRAFTING PLAN



Fig[7]:-Section of Plan

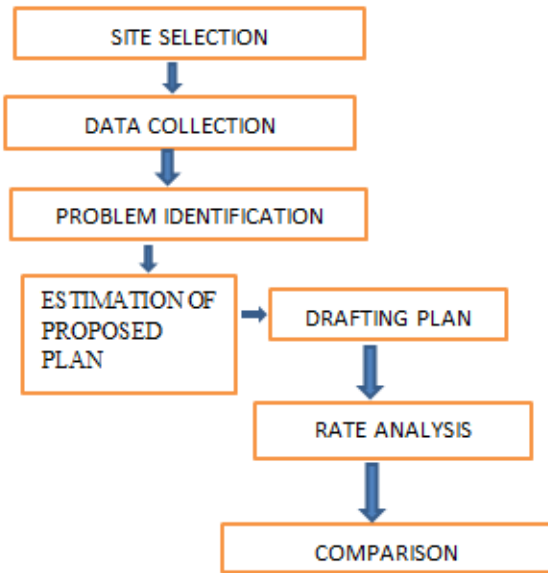


Fig[8]:- Elevation of Plan



Fig[9]:- plan

#### V. METHODOLOGY



Fig[10]:- Village Survey



VI. RESULT WITH COMPARISON

DATA FOR RAINWATER HARVESTING OF TAKLI VILLAGE:-

Sr.n	Specifications	Comparison	Cost	Difference	Saving In%
1.	Brickwork	Conventional Bond	177836 Rs	34617 Rs	19.5%
		Rat-Trap Bond	143219 Rs		
2.	Slab	Normal Slab	51446 Rs	9295 Rs	18.6%
		Filler Slab	42151 Rs		
3.	Overall Construction	Normal Method	270216 Rs	43912 Rs	16.25%
		Advance Method	226304 Rs		

Roof Top Area of House = 47.56 m<sup>2</sup>  
 Average Monsoon Rainfall in Nagpur =1064.1 mm  
 Total Quantity of Water to Be Collected = Roof Top Area (m<sup>2</sup>) X Average Monsoon Rainfall (mm) X 0.7  
 Total Quantity of Water to Be Collected =47.56 X 1064.1 X 0.7 =35,426 liters/year

VII.CONCLUSION

1. The overall cost of construction of one house by using rat- trap bond and filler slab is 16.25% less as compare to normal construction method
2. The percentage difference for brickwork using Rat Trap Bond and Slab using Filler Slab techniques as compared to conventional methods are 19.5% and 18.06%.
3. By using roof top rainwater harvesting technique a house can help to percolate 35,426 liter of water in a year.
4. We can provide a affordable house by adding extra 54,304 Rs in the government subsidy.
5. The structure make with rat-trap bond and filler slab is economical.
6. Rat trap bond wall is a one type of masonry technique the bricks are used in a way cavity within the wall. The cavity also makes the wall more thermally efficient
7. 4.The rat trap bond requires approximately 25% less bricks and 40% less mortar bag traditional masonry as compare to conventional building
8. The filler slab consume less concrete and steel due to reduce weight of slab by the introduction of a less heavy, low cost filler materials
9. Rainwater is a comparatively clean and totally free source of water, increasing ground water table and water supply cost is low.
10. Rooftop rainwater harvesting uses simple technologies that are inexpensive and easy to maintain.

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