Affordable housing scheme for Economical Weaker Section(EWS) Group

Nilay P. Golakia[1], Prof. Mrs. Sadhana Shalu[2]
[1, 2] Department of civil engineering
[1, 2] D.Y. Patil College of Engineering, Pune

Abstract- *An affordable housing is vary essential to provide shelter for the people living below poverty line in rural as well as urban area. In this paper to achieve the affordability different alternative materials are provided to the conventional construction material which also reduce the construction cost as well as completion time reduction. Case study has been carried out to redesign the housing for EWS – Economically weaker section people and cost as well as completion time comparison is carried out through HIT-Office and MSP (Microsoft project) softwares respectively. Thus suitable and best alternative is decided for housing scheme of EWS to achieve affordability and provide immediate shelter to the disaster prone area.*

Keywords- Affordable Housing, Low cost material, EWS, Bamboo Reinforcement, AAC Blocks.

I. INTRODUCTION

Millions of people across the world are living below poverty line without proper shelter. At the beginning of 12th five year plan around 18.78 million of people suffering from the housing shortage in India. A house is a very basic need of mankind. According to the Times of India, "a majority of Indians have per capita space equivalent to or less than a 10 feet x 10 feet room for their living, sleeping, cooking, washing and toilet needs." The average is 103 sq ft per person in rural areas and 117 sq ft per person in urban areas. This brings a lot of pressure on Government to provide cheap alternative solution to this group of people. With the age of urbanization rate of migration of people in search of job from rural to urban area is higher in India. Thousands of people everyday are received by the metro cities of India. As the cost of housing is not affordable for everyone in these cities problem of accommodation is arises. Thus affordable housing is one of the burning issues in the developing countries like India. Natural disasters also raised the issues of immediate shelter for the victims. Natural calamities like earthquake, flood, tsunami etc causes housing shortage to the affected areas. Thus

II. AFFORDABLE HOUSING

Affordable housing is nothing but a house which a famil or household from economical weaker section or lower income can afford for accommodation. To define the concept of affordability government of India has considered the income as well as the size criteria and decide the minimum carpet area for the different income group people(Table1).

Table 1.

Ministry of Housing and Urban Poverty Alleviation criteria for affordable housing.		
	Size	EMI or rent
EWS	Minimum of 300 sq ft super built up area Minimum of 269 sq ft (25 sq m) carpet area	Not exceeding 30-40% gross monthly income of buyer
LIG	Minimum of 500 sq ft super built up area Maximum of 517 sq ft (48 sq m) carpet area	
MIG	600-1200 sq ft super built up area Maximum of 861 sq ft (80 sq m) carpet area	
EWS:economically weaker sections; LIG: low income group; MIG: middle income group. Source: MoHUPA		

To fulfill the housing demand in India government of India has started many housing schemes across India for different income group like, Pradhan Mantri Awas Yojana (PMAY) started by MoHUPA, Pradhan mantra gramin awas yojana by MoRD, Indira awas yojana and Rajiv awas yojana. There are also many housing schemes started by different state governments.

Affordability can be achieved by using various different low cost materials for different stages of construction

like reinforcement, masonry work, flooring, door and window frame, wall finishes, painting work, plumbing etc.

A. Reinforcement

For RCC work there are two materials available for the reinforcement – steel and bamboo. Traditionally steel is used as the reinforcement material.Fe450 and Fe500 TMT bars are used as reinforcement. Thus bamboo having fibre resins is the alternative material for the reinforcement.

Bamboo

In bamboo production India is the second largest after China. Coupled with China, it holds 50% of the world's total share of bamboo production. Also it has been seen that bamboo fibers has almost similar tensile strength as that of steel (650 MPa compared to steel's lying in the range 500 - 1000 MPa). Bamboo reinforced concrete columns and bamboo reinforced concrete beams are used as non conventional building materials. Bamboo is versatile resource characterized by high strength to weight ratio and ease in working with simple tools. Bamboo needs to be chemically treated due to their low natural durability.

Figure 1.

The advantages of bamboo are:

1. Possesses high tensile strength when compared to steel, which makes it as a suitable reinforcement material.
2. It is an extremely light-weight material and the progress can be achieved without the necessity of skilled craftsmen and heavy machinery, such as cranes.
3. It is a versatile shock absorbing material which makes its application useful in the construction of lightweight houses in seismically active hilly regions.
4. It is a sustainable and renewable material due to its exceptionally fast growth.
5. The transportation costs are very minimal when compared to other construction related materials

Disadvantages, such as:

1. Bamboo is made up of starch and this requires proper treatment with appropriate chemicals prior to using for construction purposes.
2. Bamboo is stronger only at the nodes and it does not contain cross fibers, thus becomes width-wise weaker.
3. Possesses low modulus value.

B. Wall masonry

For the wall masonry there are various alternative low cost materials available like siporex (AAC blocks), lime sand bricks, concrete hollow blocks, fly ash concrete block, lightweight concrete block, foam concrete panel, glass –fiber reinforced concrete, straw panel, etc.
Siporex blocks (AAC blocks)

Autoclaved Aerated Concrete (AAC) is one of the eco – friendly and certified green building materials. Autoclaved Aerated Concrete, also known as aircrete. AAC offers incredible opportunities to increase building quality and at the same time reduce costs at the construction site. Being aerated, it contains 50 - 60 % of air, leading to light weight and low thermal conductivity. Oven dry density of SIPOREX is 400 to 650 Kg/m3, i.e. just one fourth the weight of dense concrete. It also makes SIPOREX ideal for low bearing soils, for seismic zones and for adding storey to existing buildings

Figure 2.

Figure 3.

Advantages of AAC blocks:

1. Eco - friendly: reduce at least 30% of environmental waste compared to traditional concrete and decrease of 50% of greenhouse gas emissions.
2. Lightweight: 3-4 times lighter than traditional bricks and therefore, easier and cheaper to transport.
3. Energy Saver: It is an excellent insulator.
4. Great Acoustics: can be used as a very effective sound barrier.
5. Fire Resistant: It is completely inorganic and not combustible.
6. Low Maintenance : reduces the operating cost by 30% to 40%. It also reduces overall construction cost by 2.5% as it requires less jointing and reduces the quantity of cement and steel.
7. Faster Construction : reduces construction time by 20%.

C. Wall finish:

Plaster work is the traditional way of wall finish. Usually 1:6 mortar plaster is used for brick masonry or block masonry. Thickness of the plaster varies from 12-15 mm it depends on the smoothness of the masonry. AAC block masonry gives even smooth finish surface thus there is no need of plaster work. In that case we can use the level plast putty for the wall finish so much labor work can be avoided as there is no need of plaster.

Level plast putty.

It gives walls the distinction of a smooth and glossy finish. white cement-based product is perfect for levelling concrete/mortar walls and ceilings especially when there are major undulations. It is a superior alternative of POP and gypsum finish. It gives wall and ceiling white smooth and dry surface for painting by filling pore of concrete/mortar. it possesses more adhesive strength and durability, while increasing the life of your paint.

Advantages:

1) Durable, User-friendly
2) Saves Labour and Time
3) Long Lasting and Water Resistant
4) Higher Tensile Adhesion Strength, Higher Bond Strength, Higher Compressive Strength
5) Superior Whiteness
6) Low Water capillary absorption, Does not flakes, when in contact with moisture
7) Application on both interior and exterior surface.
8) Bonds best with grey cement plastered surface or RCC surface.
9) No curing as well as primer required.
10) Can be use on RCC surface, without hacking the RCC surface and as a substitute of plaster

Distemper

Distemper is an early form of whitewash, also used as a medium for artistic painting, usually made from powdered chalk or lime. Distempered surfaces can be easily marked and discolored, and cannot be washed down, so distemper is best suited to temporary and interior decoration. The technique of painting on distempered surfaces blends watercolors with whiting and glue.

Advantages

a) low cost 30-55 Rs/kg various with companies.
b) Low labor cost 10-15 Rs per square feet.
c) Easy and faster work
d) Immediate temporary solution for painting.

D. Flooring materials :

Ceramic flooring

Ceramic tiles are a versatile architectural resources that can be employed in a variety of environments without having to worry about the constraints of water, stains, and design. Glazed ceramic flooring tiles have a protective layer that rests over the material, making them impervious to water and stain penetration. They are also naturally resistant to the ravages of high humidity conditions. These properties make them ideal for use in moist environments such as bathrooms or kitchens. Ceramic tiles come in several forms and finishes. They include porcelain, mosaic, terracotta, glazed and quarry types.

Advantages :

1) Water Resistance:
2) Durable
3) Dirt, stains, and liquids all rest on the surface, allowing you to easily wipe
4) Cost effective : 40-150/Sq.feet.

D. Door and Window:

Conventionally natural wood door and window frames are used for door and window work. There are many other non conventional alternatives available like particle board, MDF board, Aluminum door and windows, steel door and windows which are cost effective compare to the natural wood.

Aluminum door and window frames:

Aluminum door and window frames are used as an alternative to the timber door frames. Which increases the durability and life of the frame. Easy installation of doors and windows is carried out. Aluminum door window frames should be according to IS: 1948 and I S: 1949 on manufacturing. These frames give beautiful looks, require no painting and less maintenance cost and are free from termite attack, rusting problems etc.

a) Slim Profile
b) Durable
c) Narrow sight lines
d) Low Maintenance
e) Cheaper than timber

Figure 4.

III. COST ESTIMATION FOR EWS - RESIDENTIAL APARTMENT

For cost comparison of conventional method and non conventional method a case study has been carried out. A residential apartment having flat size (~320 sq.ft) according to the criteria for EWS is taken and redesign its construction using non conventional construction material for different segment of the construction.

Figure 5.

Cost estimation is carried out for both methods – conventional method as well as non conventional method in ERP software HIT-office.

Reinforcement – Bamboo reinforcement
Brick work – AAC blocks masonry
Plaster work – Level plast white putty
Painting – Distemper paints
Flooring work – Ceramic tiles
Door and window – Aluminum door and windows.

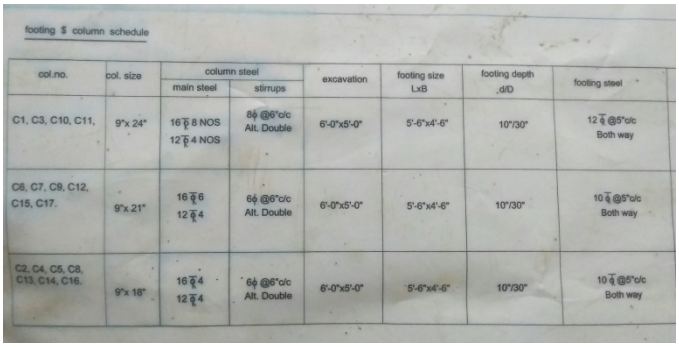

Figure 6.

Usage of non conventional materials also reduced the overall construction time as well as reduce the labour cost. Construction time and Labour cost is estimated and compare using MSP (Microsoft project) software.

Table 2.

Bamboo reinforcement				
		materials for bamboo tratment		
segment	length (m)	biding wire	sand	primer coating
		0.078 kg/m	50 gm/m	50 ml/m
footing	517.4			
column	7210			
beams	11193			
slabs	2111			
Total length(m)	21031.4	1640.4492	1051.57	1051.57
cost (Rs)	210314	82022.46	588.8792	110414.85
Total cost (Rs)	403340.1892			

HIT-office summery for EWS apartment

Cost estimation is carried out for conventional method as well as non conventional method in HIT-Office software.(image5)(image6)

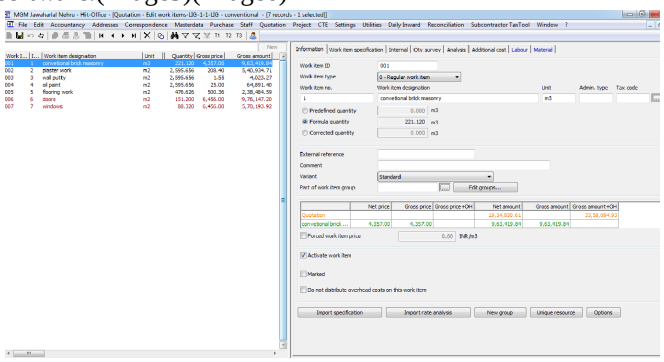

Figure 7.

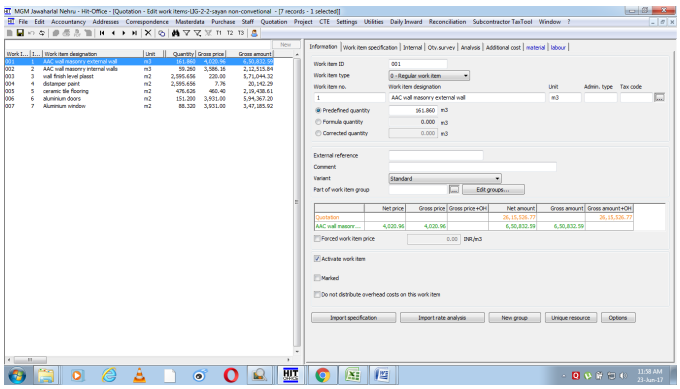

Figure 8.

Cost comparison of the both has been carried out.

Table 3.

EWS - non conventional					
No.	Description	Quantity	Unit	Rate	Amount
1	AAC wall masonry external walls	161.86	m3	4020.86	6,50,832.59
2	AAC wall masonry internal walls	59.26	m3	3,586.16	2,12,515.84
3	Wall finish level plast	2,595.66	m2	220	5,71,044.32
4	Distamper paint	2,595.66	m2	7.76	20,142.29
5	Ceramic tile flooring	476.626	m2	460.4	2,19,438.61
6	Aluminium doors	151.2	m2	3,931.00	5,94,367.20
7	Aluminium window	88.32	m2	3,931.00	3,47,185.92
			Total Amount		**26,15,526.77**

From the above comparison 22.11% cost can be reduce by using various non conventional building materials as an alternative to the conventional building materials.

MSP summery for EWS residential apartment

Construction time as well as labour cost is estimated by preparing a time schedule of various construction activities by using MSP software for both the construction methods – conventional and non-conventional (image7,8).

Table 4.

EWS – conventional					
No.	**Description**	**Quantity**	**Unit**	**Rate**	**Amount**
1	Convetional brick masonry	221.12	m3	4357	9,63,419.84
2	Plaster work	2,595.66	m2	208.4	5,40,934.71
3	Wall putty	2,595.66	m2	1.55	4,023.27
4	Oil paint	2,595.66	m2	25	64,891.40
5	Flooring work	476.626	m2	500.36	2,38,484.59
6	Doors	151.2	m2	6,456.00	9,76,147.20
7	Windows	88.32	m2	6,456.00	5,70,193.92
			Total Amount		**33,58,094.93**

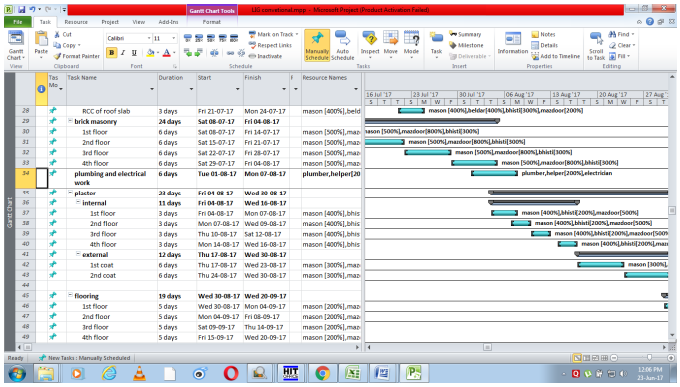

Figure 9.

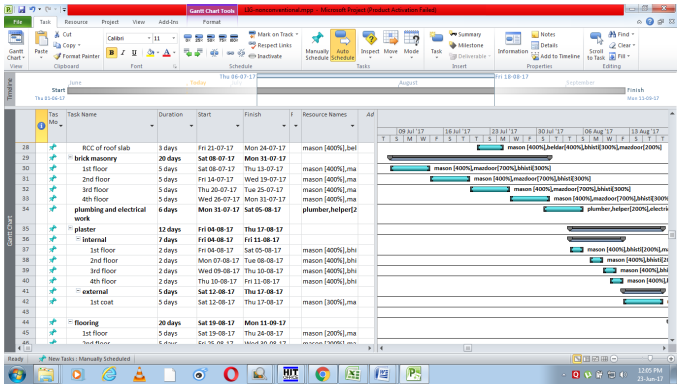

Figure 10.

Construction time and labour cost comparison

Table 5.

Time and Labour cost summery of EWS		
	Time	**Labour cost (Rs)**
Conventional method	94 days	886388.96
Non-conventional method	88 days	786263.04
Savings	**6 days**	**100125.92**

From the above comparison it shows that 11.29% per day labour cost can be reduced by using non conventional method of construction. With proper planning total construction time can be more reduced to provide faster shelter for the EWS people.

V. CONCLUSION

Using various alternative non conventional materials is a feasible option for material cost reduction, construction and per day labour cost reduction.

a) 46.76% cost reduction can be achieved in reinforcement.
b) 22.11% cost reduction achieved in various construction works
c) 11.29% per day labour cost can be reduced.

It shows that it is significant to easily provide affordable housing schemes for different income groups like EWS, LIG, MIG. Many alternative non conventional materials are found for different segment of construction. Such studies should be done for LIG & MIG income group.

REFERENCES

[1] Low cost housing : Rinku Taur and Vidya Devi , ACSGE-2009, Oct 25-27, BITS Pilani, India

[2] Cost Effectiveness of using AAC Blocks for Building Construction : Shweta O. Rathi, P.V. Khandve

[3] Replacement of Steel by Bamboo Reinforcement, Anurag Nayak, Arehant S Bajaj, Abhishek Jain, Apoorv Khandelwal, Hirdesh Tiwari, Sanghvi Institute of Management & Science Behind IIM-Indore, Pigdambar, 453331, Indore, India

[4] Study on Bamboo as Reinforcement in Cement Concrete by Jigar K. Sevalia, Nirav B. Siddhpura, Chetan S.

Agrawal, Deep B. Shah, Jai V. Kapadia, SVNIT ,Surat.

[5] BIS : 9096,2006. Standard code for preservation of bamboo for structure.

[6] Pune,region DSR -2016-17

[7] Review of bamboo as reinforcement

[8] Material in concrete structure by Ajinkya Kaware, Prof. U.R.Awari, Prof. M.R.Wakchaure, A.I.S.S.M.S C.O.E. Pune, Mahrashtra, Inida Siporex India Pvt.ltd.

[9] Performance Evaluation Of Bamboo As Reinforcement In Design Of Construction Element by Dr. Patel Pratima A, Maiwala Adit R. , Gajera Vivek J. Patel Jaymin A., Magdallawala Sunny H.