Feasibility Analysis of Low Cost Material Housing

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Abstract - Raising area costs is driving out oppressed individuals that serve advantaged individuals being dis- housed. The housing shortage has now become a major issue next just in significance to the food deficiency in India. This has been because of the mass neediness and financial backwardness, the two of which block the proficient usage of the current accessible assets for social housing and development on a satisfactory scale. Personal satisfaction is abominable for EWS (Economically Weaker Section) which presently represents 60% of the metropolitan populace constraining them to migrate further. In low – cost housing projects, there is a need to get inventive arrangements by thinking about the entirety of the issue. This Dissertation delivers the way to deal with limit the expense of a unit in Low – Cost Housing development in India by decreasing the length of the project by utilizing different strategies and materials without losing quality. In research it came to know, two variables influence the expense of low-cost housing i.e., time, the material utilized. These three variables were kept as the base of this whole research. The research was concluded by giving a cost analysis & comparison between Conventional and Alternative Materials.

Key Words – Low Cost, Affordable Housing in India, Response Spectrum

I.INTRODUCTION

General Introduction

In creating nations, for example, India, just 20% of the populace are high-pay workers, who can manage the cost of typical housing units. The housing market has gone through a consistent change throughout the long term and it has changed for the better. The low-pay bunches in creating nations are commonly incapable to get to the housing market. And therefore, low-cost housing becomes possibly the most important factor it is an overall idea and has more to do with planning and tries to decrease development costs through better administration, fitting utilization of nearby materials, abilities, and innovation yet without yielding the exhibition and structure life.

The cost decrease is accomplished through the powerful use of locally accessible structure materials. The economy is likewise accomplished by deferring completing and executing ease lodging advances in stages.

II.LITERATURE REVIEW

Parth tiwari, Kumar A.(2011) 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 labour cost, can be saved by using the low cost housing technologies in comparison with the traditional construction methods for walling and roofing respectively.

Swaptik Chowdhury, Sangeeta Roy(2013) Carried out study on Prospects of affordable housing in India, it is observed that in this paper alternative construction materials mainly natural material such as bamboo, Jute coir composites, coconut and wooden chips roofing materials, Manmade materials like fly ash, Ferro cement, were studied and the potential of these materials to be used as alternate building materials is brought out.

Archana Dongre, Vinay Kumar(2017) This project is work developed to reduce the cost of a

2 bed room house. Replacement of fly ash in 25% to 30% gives more compressive strength compared to ordinary concrete and more smoothness in walls need not require any plastering.

Bimal Patel, Brijesh Bhatha(2017) This study analyses the impact of relaxing a few mandatory building and site planning regulations on the cost of small two-room homes in Ahmedabad by developing two alternative layouts for the same site, one in accordance with prevalent regulations, and another after modifying a few regulations. It shows that rationalizing regulations can reduce housing cost by 34% and increase supply by as much as 75% without significantly lowering quality or compromising safety.

Harshit gupta(2020) The outcome shows that, by utilizing ease materials like Fly ash blocks, Robo sand, Basalt bar, UPVC windows, and Vitrified tiles, the expenses have been decreased and spared to 20% in any development without lessening its quality. Henceforth the recommendation from the work is to utilize acceptable quality ease materials for the structures for low-pay individuals.

III.RESEARCH OBJECTIVE

1. To examine the present housing scenario in India and identify the research gap.
2. To study the various Construction techniques that can be used to reduce the cost of construction and alternative materials which can be used for affordable housing.
3. To understand the affordable housing parameters and study the structural behaviors of low-cost materials and their load distribution technique with the help of ETABS Software.
4. Cost analysis of these dwelling units using traditional constructional materials and new low-cost materials studied and calculating the percentage reduction in cost for the scheme.

IV.PROJECT SCOPE

The cost estimation is done roughly by referring to standard rates and percentages for Low-cost techniques as per DSR 2022. This may result in a less degree of accuracy. These results may not hold well in case of rural conditions. Thus, there is a try for deviation of results. The cost is estimated assuming first conditions and may vary depending upon the suitability and availability.

V.METHODOLOGY

Response Spectrum Method

Response Spectrum Method a linear static analysis is simply a plot or steady-state response (displacement, velocity or acceleration) of a series of response of varying Regular frequency that are forced into motion by same base vibration. The resulting plot can then be used to pick off the response of any linear system, given its Regular frequency of oscillation. One such use is in assessing the peak response of building to seismic.

Seismic Base Shear

According to IS 1893-2016 (Part-I), Clause 7.5.3 the total design lateral force or design seismic base shear (Vb) along any principal direction is determined by,

$$Vb = A_h.\times W$$

Where,

Ah is the design horizontal acceleration spectrum

W is the seismic weight of building

Design Horizontal Acceleration Spectrum Value

For the purpose of determining the design seismic forces, the country (India) is classified into four seismic zones (II, III, IV, and V). Previously, the five zones, of which Zones I & II Are merged into Zone II in fifth revision of code. According to IS 1893: 2016 (Part 1), Design Ah Seismic Forces Coefficient Ah for a structure shall be determined by following expression.

$$Ah = (Z/2) *(I/R) *(Sa /2g)$$

Where, Z = Zone Factor Seismic Intensity I= Importance Factor R= Response Reduction Factor

VI.PROBLEM FORMULATION

Analyzing the feasibility regarding new materials as construction materials with its sustainability towards loads taking following cases

1) G+4 framed structure,

2) G+10 framed structure with lift provisions, (As

per the norms given by government) into consideration and performing the cost analysis study. With the help of AutoCAD and ETABS software.

G+4 Framed Structure

1) Red Earth Brick

1. Red bricks are composed of clay soil.
2. Red brick has colour red to light brown.
3. Red brick does not have a uniform shape as they are hand mould-made.
4. The compressive strength of red brick is 30-35 kg/cm².
5. The density of red brick is about 1600-1750kg/m³.
6. Wastage on the site of red brick is more than 10%.
7. The weight of red brick is about 3.5kg.
8. The cost of red brick is more than fly ash brick.
9. Red Bricks, Size: 9 Inch × 4 Inch × 3 Inch.

2) Fly Ash Brick

1. These bricks are composed of cement, slag, fly ash.
2. Fly ash bricks have a cement grey colour.
3. These bricks have a uniform shape as they are cast in machine mould.
4. The compressive strength of fly ash brick is 75-100 kg/cm².
5. The density of fly ash brick is about 1700-1850 Kg/m³.
6. Wastage of these bricks is around 2-5% on-site.
7. The weight of fly ash bricks is 2.6kg.
8. Fly Ash Bricks, Size: 9 Inch × 4 Inch × 3 Inch.

Table 1 Preliminary Data for Design

Type of structure	Frame Structure
Moment-Resisting frame	SMRF
No. of Stories	G+4, G+10
Height of Each Story	3m
Height of Ground Story	1.5m
Thickness of slab	150mm
Thickness of outer wall	230mm
Thickness of inner wall	150mm
Grade of reinforcing steel	Fe 415 & Fe 500
Density of concrete	25 KN/m^3
Density of wall	20 KN/m^3
Grade of concrete in slab	M30
Grade of concrete in beam	M30
Grade of concrete in column	M35
Grade of concrete in footing	M35
Seismic Analysis	Dynamic
Seismic zone	III
IS Code	IS 456 2015, IS 875-2015 part –I, II & III. IS 1893-2016, IS 13920 2016
Basic wind speed	39m/sec

Loads Considered

Load Case and Load Combination

Unless otherwise specified, all loads listed, shall be considered in design for the Indian Code following load combinations shall be considered,

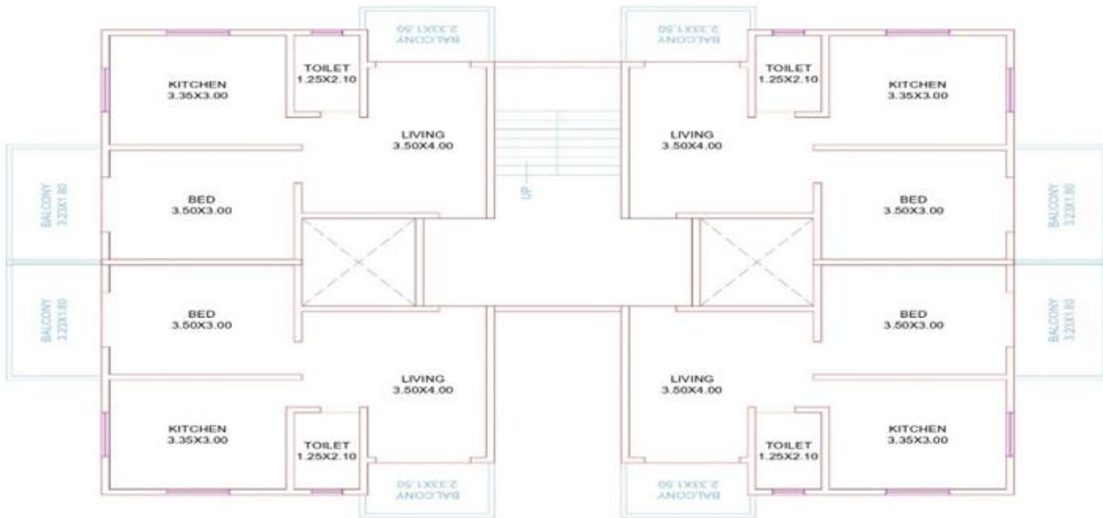
Load Case

1) DL: Dead load
2) LL: Live load
3) EQ: Earthquake load
4) W: Wind Load

Load Combination

1) 1.5DL+1.5LL
2) 1.2DL+1.2LL + 1.2EX
3) 1.2DL+1.2LL- 1.2EX
4) 1.2DL+1.2LL+ 1.2EY
5) 1.2DL+1.2LL - 1.2EY
6) 1.2DL+1.2LL+1.2WLX
7) 1.2DL+1.2LL-1.2WLX
8) 1.2DL+1.2LL+1.2WLY
9) 1.2DL+1.2LL-1.2WL

A. Building Plan

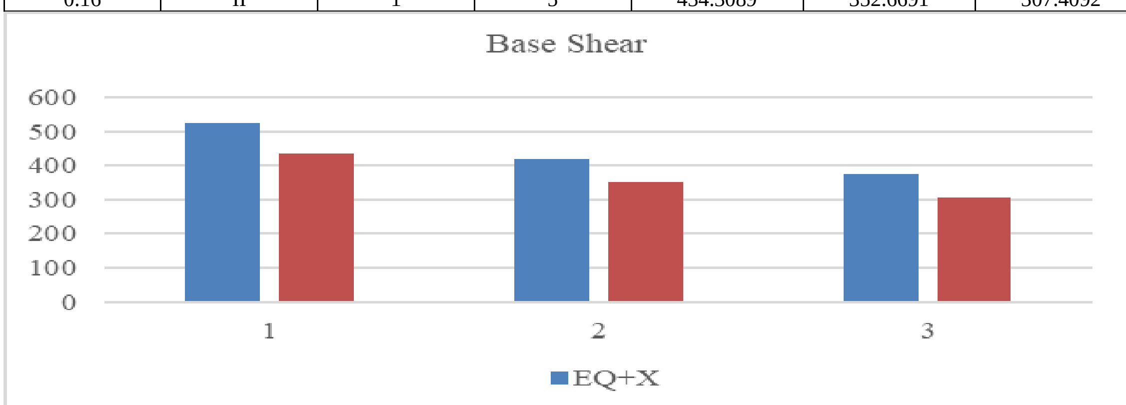


VII.RESULTS

In the present study, Relative Analysis of RCC structure with different types of infill wall materials building i. e. Brick Infill Wall, Fly Ash Wall and ACC Blocks Infill Walls

Table 2. Base Shear Results for Different Types of Wall materials i.e. Brick Infill Wall, Fly Ash Wall and ACC Blocks Infill Walls

Z	Soil Type	I	R	Base Shear	Base Shear	Base Shear
				KN	KN	KN
0.16	II	1	5	523.3107	420.1119	373.7937
0.16	II	1	5	523.3107	420.1119	373.7937
0.16	II	1	5	434.3089	352.6691	307.4092
0.16	II	1	5	434.3089	352.6691	307.4092



Graph 1. Base Shear vs. Different Types of Wall materials i.e. Brick Infill Wall, Fly Ash Wall and ACC Blocks Infill Walls

Table 3 Earthquake Displacement Results for Different Types of Wall materials i.e. Brick Infill Wall, Fly Ash Wall and ACC Blocks Infill Walls

TABLE: Diaphragm Centre of Mass Displacements				
Story	Load Case/Combo	UX	UX	UX

		mm	mm	mm
Terrace Slab	EQ+X	18.18	17.111	18.053
10th slab	EQ+X	16.396	15.3	16.036
9th slab	EQ+X	15.163	13.987	14.528
8th slab	EQ+X	13.719	12.509	12.897
7th slab	EQ+X	12.085	10.872	11.119
6th slab	EQ+X	10.29	9.179	9.332
5th slab	EQ+X	8.393	7.426	7.508
4th slab	EQ+X	6.462	5.666	5.692
3rd slab	EQ+X	4.579	3.97	3.961
2nd slab	EQ+X	2.866	2.47	2.457
1st slab	EQ+X	1.391	1.192	1.186

Graph 2 Earthquake Displacement for Different Types of Wall materials i.e. Brick Infill Wall, Fly Ash Wall and ACC Blocks Infill Walls

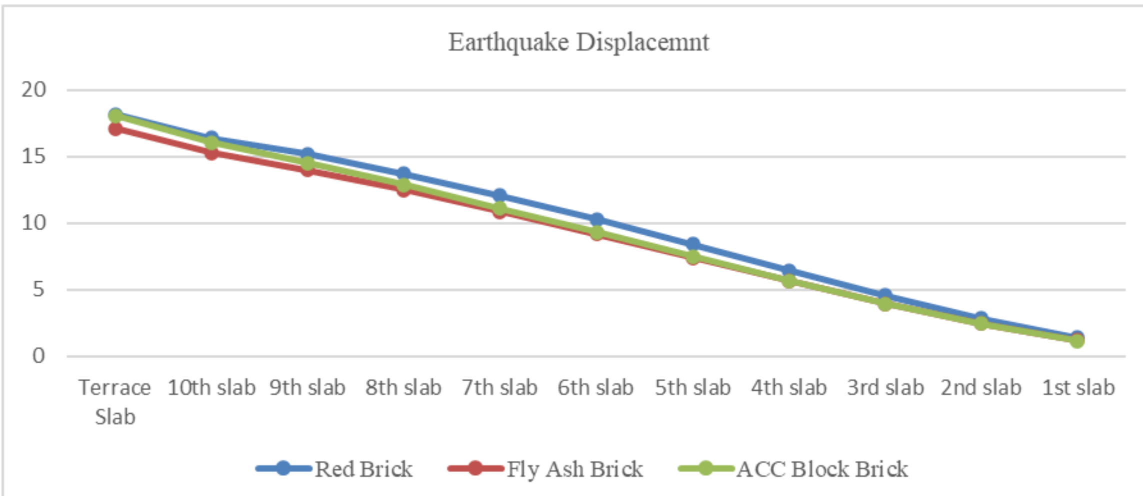
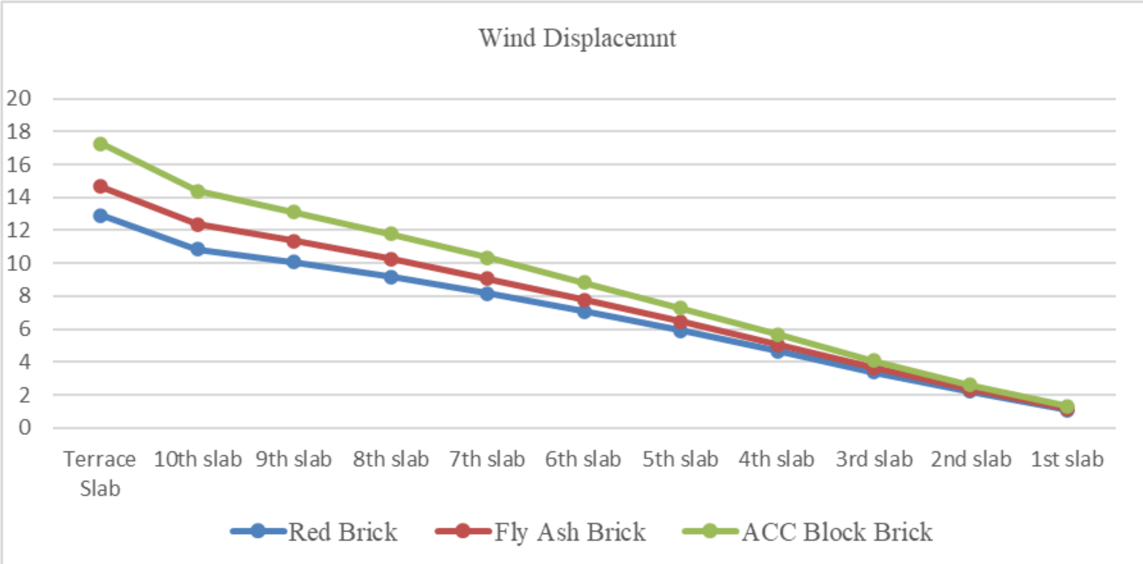


Table 4. Wind Displacement Results for Different Types of Wall materials i.e. Brick Infill Wall, Fly Ash Wall and ACC Blocks Infill Walls

TABLE: Diaphragm Centre of Mass Displacements				
Story	Load Case/Combo	UX	UX	UX
		mm	mm	mm
Terrace Slab	WL+X	12.92	14.679	17.276
10th slab	WL+X	10.841	12.352	14.396
9th slab	WL+X	10.056	11.353	13.124
8th slab	WL+X	9.169	10.261	11.787
7th slab	WL+X	8.181	9.058	10.333
6th slab	WL+X	7.09	7.796	8.846
5th slab	WL+X	5.91	6.454	7.286
4th slab	WL+X	4.668	5.057	5.676
3rd slab	WL+X	3.404	3.651	4.073
2nd slab	WL+X	2.199	2.346	2.612
1st slab	WL+X	1.103	1.171	1.305

Graph 3. wind Displacement for Different Types of Wall materials i.e. Brick Infill Wall, Fly Ash Wall and ACC Blocks Infill Walls



VIII.CONCLUSION

In the present study, Relative Analysis of RCC structure with different wall types materials i.e. Infill Brick wall, Infill fly ash wall and ACC Blocks wall building with G+10 story building. The structures are analyses for earthquake zone III with medium soil and Results Compare. It has been made on different structural parameters viz. Base Shear, Earthquake Displacement, Wind Displacement, Story Force, Modal Time Period and Story Drift etc. Grounded on the analysis results following conclusions are drawn.

1. Base Shear Comparison G+4 story building, Base shear of different type of wall materials i.e. infill brick wall, fly ash infill wall, and ACC Blocks wall, base share is 1.29 times increased with compare to Fly ash infill wall. Also in G+10 story building, base share is increased in brick infill wall, as compare to fly ash wall and ACC Blocks walls i.e. 1.246 times and 1.399 respectively, Earthquake base shear of fly ash wall material is good performance in base shear results.
2. In earthquake Displacement in G+4 story building. Top Story displacement of different types of wall materials i.e. Brick infill wall, Fly ash Infill wall. Earthquake displacement is increased in Brick infill wall as compare to Fly Ash infill wall displacement is increased almost 24.975 % in G+4 story building. Also in G+10 building in different types of wall i.e. Brick infill wall, Fly Ash infill wall and ACC Blocks wall etc. displacement is increased in Bricks infill wall as compare fly ash infill wall and ACC Blocks infill wall almost 1 to 6% displacement is decreased both building shows good performance in earthquake displacement results.
3. Building analysis for Wind Displacement in G+4 story building. Top Story displacement of different types of wall materials i.e. Brick infill wall, Fly ash Infill wall. Wind displacement in G+4 story building almost both building performance is same for wind load. Also in G+10 building in different types of wall i.e. Brick infill wall, Fly Ash infill wall and ACC Blocks wall etc. displacement is increased in ACC blocks infill wall as compare Brick infill and fly ash infill wall displacement is decreased 33.37% & 13.61% Wind displacement results in fly ash building is good.
4. In G+4 story building, story force results for both material building performance is same in story force results. Also in G+10 story building for different wall materials i.e. Brick infill wall, Fly Ash infill wall and ACC Blocks Infill wall etc. story force increased in brick infill wall as compare to all other materials. But story force is decreases almost 1 to 10 % in fly ash infill wall and ACC

Blocks infill wall

5. Time Period Comparison, in different types of wall materials i.e. Brick infill wall, Fly Ash infill wall and ACC Blocks Infill wall time period increases in brick infill wall almost 11.96 % and 3.8% as compare to fly ash Infill wall and ACC blocks infill walls.
6. Drift Comparison for earthquake loading in different types of wall materials i.e. Brick infill wall, Fly Ash infill wall and ACC Blocks Infill wall, all building shows linear behavior in story drift results.
7. All building result are compare i.e. Brick infill wall, Fly Ash infill wall and ACC Blocks Infill wall but overall performance of Fly Ash infill wall materials is best performance in almost in all results.

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