TO STUDY THE GAP ANALYSIS & COST ESTIMATION FOR EFFECTIVE SELECTION OF MODERN METHOD OF CONSTRUCTION IN INDIA

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ABSTRACT

Modern Method of Construction (MMC) for affordable housing as a concept is very generic and could have different meanings for different people based on differences in level of Incomes. The Affordable housing can be defined to any housing that meets some form of affordability criteria. Many countries refer affordable housing for presenting the economic status of an individual who is buying a house. The research is about finding the gap analysis for affordable Housing along with the cost comparison & effective selection of the modern method of construction. This will help to identify the factors affecting the selection of MMC based on earlier research done and what innovation and adaption can be done while adopting MMC concept in India.

Keywords: Modern Method Of Construction, Affordable Housing, Gap Analysis, Cost Comparison.

I.   INTRODUCTION

The demands rising for affordable housing in India and the interest of developers to invest in affordable projects of Housing mandates a clear picture and appreciation of the cultural values and lifestyles of the society. The economic slowdown in India is leading to rise in interest rate and credit scarcity. The developers in such times are having difficulty to find buyers for premium apartments. This has motivated developers towards cost effective housing projects. The past decade has witnessed a period of economic transformation in the real estate industry. After the global financial crisis, India bounced back magnificently leaving it with the question of what next. Private Builders & Developers have been rigorously pursuing affordable housing after the economic slowdown of 2008. The housing was being restructured and there was an acute refocusing of the product to meet the end user demands. Affordability in housing has proven to be the need of the hour due to increasing user demands. The real estate sector is widely linked one, having linkages with over 200 industries and has a huge multiplier effect on growth. Thus, affordable housing forms a key part in the vision of transforming the country's real estate practices to next level.

II.   GAP ANALYSIS

Based on Earlier research paper we will Identify the Areas for Innovation & Factors affecting Modern Method of Construction. Following are the studies from last 10 years from which we will help us identify the gap for Improvement and selection of Modern Method of Construction: -

A. STUDIES OF AFFORDABLE HOUSING

1) Mohd-Rahim, F. A., Zainon, N., Sulaiman, S., Lou, E., & Zulkifli, N. H. (2019). In Malaysia for low-cost housing Factors that affecting the ownership for social Devolvement. (AHC_2019_1): -

Study conducted in Malaysia for factors like Location of public facilities, Safety, Facilities, Location of transportation, Lift maintenance, Corridor lights, Bins, Extinguisher, Parking, Building maintenance, Rental management, Garbage management, Classification of respondents by gender, Classification of respondents by race, Classification of respondents by age, Classification of respondents by household income, Classification of respondents by employment sector , Classification of respondents by marital status , Classification of respondents by household size, Classification of respondents by religion , Classification of respondents by length of residency, Sample size =500 ,Frequency tables ,Graphical data.

2) Yap, J. B. H., & Ng, X. H. (2018). Malaysia Housing affordability: the perception, the price range ,the influencing factors and policies. (AHC_2018_3)

Study conducted in Malaysia for factors like, Definition of affordability (Bank Negara Malaysia 2016) ,Housing affordability rating, Factors affection housing affordability, Speculation on interest rates, Demand and Supply, Income, Demographics, Residential property price, Land cost ,Construction cost, Changing economic growth

and human psychology, Developer profit margins, Survey respondents are real estate agency, developer, Frequency tables, Graphical data, Responses collected through interviews

3) Tan, W. L., & Goh, Y. N. (2018). The psychological factors role in influencing the consumer buying intention towards green residential building. (AHC_2018_2)

Green Residential building, Study conducted in Malaysia stated that Demographics data are classified w.r.t living state, property ownership, gender, age, nationality, education, monthly income and marital status, Factor loading, Cronbach's alpha, Composite reliability (CR), AVE (average variance extracted), Perceived value, Perceived self-identity, Perceived risk

4) Olanrewaju, A. L., Lim, X. Y., Tan, S. Y., Lee, J. E., & Adnan, H. (2018). The Factors That affecting housing cost in Malaysia: analysis of the supply side. PLANNING MALAYSIA, 16(6) (AHC_2018_1)

Study conducted are Factors of Location – urban/rural, Size of the house, Innovation and skills, Developers and profit margins, Strategic factors, Shortage of materials, Rising labor cost, Economic uncertainty and financial risk, Planning restriction on the use of land, Quality of material and component use, Lease hold/free hold house, Climate changes, Interest rates, Household confidence on future price, No. of new house being built, Geographical factors, Availability of facilities, Layout of the house, Stamp duty, Currency exchange rates, Permit fees, Frequency table, Ranking factors

5) De, U. K., & Vupru, V. (2017). House choice for Location & neighborhood conditions and its rent cost. (AHC_2017_2)

Study conducted in Urban Area of North-East India, Social-economic factors, Neighbor factors, Respondents are classified w.r.t family size, income, education of head of family, water availability, security, convenience to access work-place and road condition, Regression analysis is used to examine impacts of various potential factors on rent, Review of literature, Respondent are also classified w.r.t community, vehicles ownership, domicile status, Variables, Family size, Family income, Education of head, Occupation of head , Carpet area of house , Age of house, Location near stream, river, lake, Quality of approach road, Distance of workplace, Distance of market, Distance from forest cover, Distance from railway station, View of green cover, Security status, Neighboring community, Water supply.

6) Olanrewaju, A., & Woon, T. C. (2017). The Determinants exploration of choice of affordable housing . (AHC_2017_1)

Study Conducted for factors like Type of building, Unit size, No. of bedrooms, No. of bathrooms, Presence of parking area, Building location, Excess to health care, Excess to child care center and school, Location of shopping mall and market, Accessibility of working place, Proximity to govt. establishment, Availability of public transportation, Household income, Family size, Interest rates, Economic trends, Availability of mortgages, Aesthetic views, Taxation influence, Crime.

7) Zyed, Z. A. S., Aziz, W. N. A. W. A., & Hanif, N. R. (2016). Housing affordability problems among young households. Journal of Surveying, Construction and Property, 7(1), 1-18. (AHC_2016_4)

Study Conducted for factors like House price, Household income, Housing choice, Research methodology, Quantitative research approach, Questionnaire survey, IBM SPSS SOFTWARE

8) Analysis of Economic Determinants of Affordable Housing Prices. (AHC_2016_3)

Study Conducted for factors like Strategic (for e.g., school, hospitals, place of job, market etc.), Size of house, Location – urban/rural, Leasehold / Freehold house, Recreational facilities, Layout of the house, Transportation, Land acquisition, Levy (tax), Permit fees, Stamp duty, Government policies

9) The Gan, X., Zuo, J., The Chang, R. The Li, D., & the Zillante, G. (2016). The determinants Exploring of migrant workers having choice of housing tenure towards public rent house: A case study in Chongqing, China. Habitat International, 58, 118-126. (AHC-2016_2)

Study Conducted for factors Housing tenure choice, Economic perspectives, Socio demographic perspectives, Socio economic factors, Location factor , Economic factor, Socio demographic factors, Significantly affect migrant workers, Age, Gender, Income, Marriage, Education attainment, Income , Employ sector, Family size, Tenure security, Affordability, Accessibility, Cultural adequacy, Housing unit, Related services and infrastructures, Neighborhood environment, Adequate housing, Attributes of housing adequacy, Public facilities, Housing policies, Housing amenities, Housing interior design, Indoor environment, quality and safety, Building external design and landscape, Housing affordability, Facility management.

10) Delgado, A., & De Troyer, F. (2017). In Guayaquil, Ecuador The preferences for Housing for affordable social house projects . (AHC_2016_1)

Study Conducted for factors Social implications: improvement of quality of life, Housing characteristics, Layouts: housing level, urban environment level, urban green areas, road infrastructure projects, Technical choices: elements like floors, walls, roofs etc and material, Location of the project: distance to the center of the city by public transportation, natural conditions, road infrastructure, basic infrastructure, Research type, Data collection, Analysis of information for model simulation, Optimization of model results, Basic concern, The quality of life to be provided by the project at the urban and housing levels, The overall financial feasibility, The projects affordability for the intended target groups, Factors, Location of the urban projects, Layouts (commercial area), Housing layouts (housing type, individual unit, attached, semi attached, housing plot type, plot dimension, street type), Technical characteristics (wall and floor finishes, ceiling)

11)   Salama, A. M. (2006). In Saudi Arabia the theory of life style approach for research of affordable housing. (AHC_2006_1)

Study Conducted for factors like Space preferences, Payment method, Affordability, Pre tested location, Pre tested area, Typological preferences, Location and neighborhood, Age, Gender, No. of cars, No. of family members, Graduation level, Work sector, Income level, Domestic labor, Degree of satisfaction, Advantages, Type and no. of spaces, Neighborhood, Ownership status, Name type.

B. Following are Major factors for which we have given symbols for gap analysis.

SYMBOLS	Factor
A	Location of public utilities
B	Building Amenities
C	Availability of local transportation
D	Government red tapism
E	Land cost
F	Construction cost
G	Perceived financial risk
H	Availability of geographical factors like climate, terrain
I	Layout of house
J	Carpet area of the house
K	Location nearness from river, stream, lake, forest cover
L	View of green cover
M	Security status/ Crime
N	Neighboring community
O	Technical characteristics of construction
P	Subsidized Taxation
Q	Affordable housing
R	MMC methods

A. GAP ANALYSIS

B. FINDINGS OF GAP ANALYSIS

- Land cost & construction cost have already been studied exhaustively.
- Use of MMC in construction has been studied less.
- Precast application is studied thoroughly.
- Affordable housing consists of conventional method studied exhaustively.
- Carpet area of the house, government red tapism & location of public utilities have been studied thoroughly.
- Building amenities, layout of house & technical characteristics of construction have been studied less.
- Availability of local transportation, subsidized taxation & neighboring community have not been studied much.
- Ease in availability of Loan, labor cost, Security status, view of green cover & perceived financial risk has been studied the least.
- Most of the management issues have their roots in false or missing information of one kind or another. In several cities, candidates for inclusion in the city-sponsored reasonable housing could also be needed to use a pay stub so as to demonstrate that their financial gain qualifies them for reasonable housing.
- The analysis discovered a modest however important decline within the variety of terribly low-income rental households, experiencing worst case housing wants from 2011 to 2013, 7.7 million terribly low-income renter households, or 41.7% of the terribly low-income renter population, had worst case housing wants.

III.   COST ESTIMATION FOR PRECAST SYSTEM

BUILDING PLAN FOR CALCULATION:

For Detail Analysis of cost and time between cast on site & precast panel system Following Figure 1.1 is used.
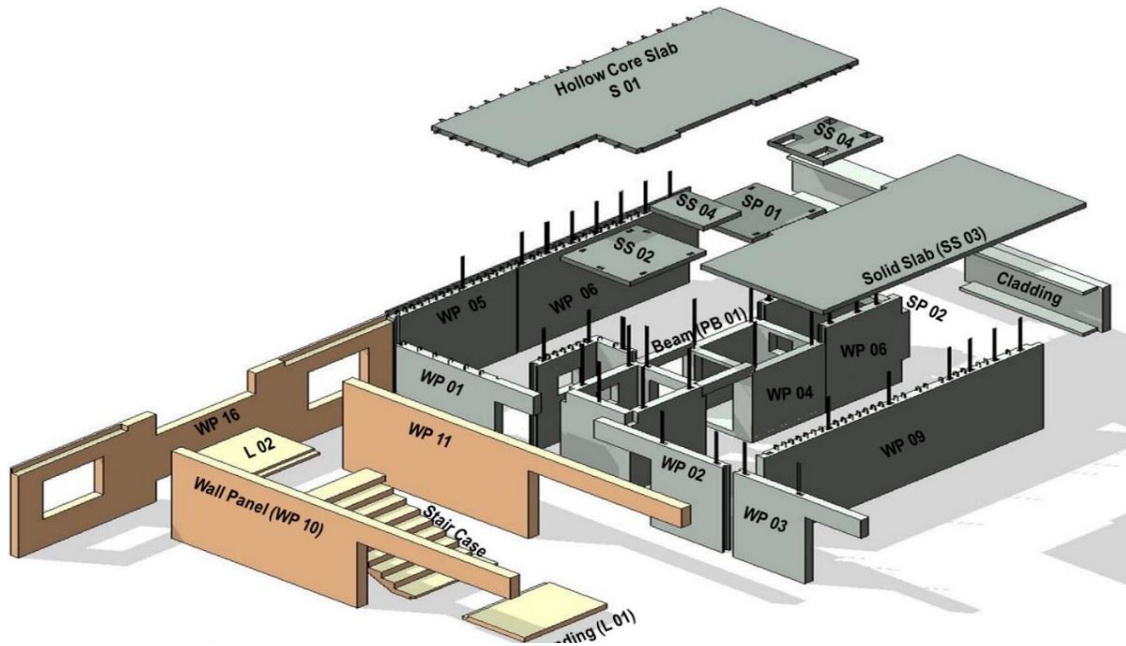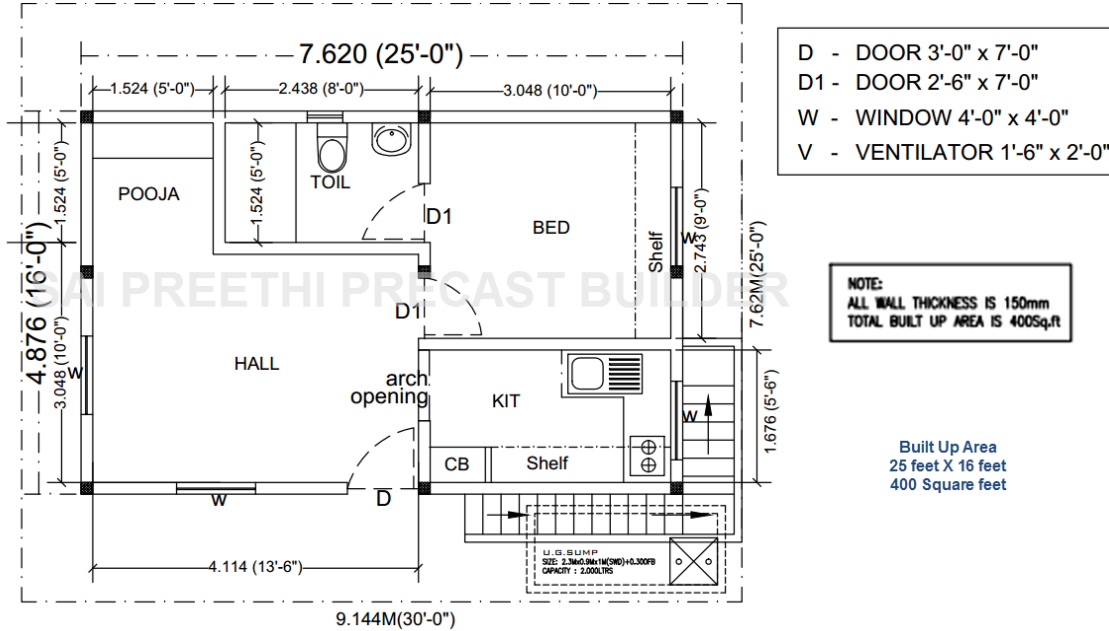

Fig No 1.1 (BUILDING PLAN FOR CALCULATION)

i. **COST CALCULATION FOR PRECAST (Cost Calculation for Fig no 1.1)**

A. **PRECAST COLUMN FOR M25 GRADE:**

- Column Size   = 1.64X1.64X10 feet
- Total volume   = 26.89 Cubic feet
- Steel required   = 30 kg
- R.M.C rate for 1 Cubic Feet concrete   =Rs. 116
- for 2.5 cubic Feet concretecost

= (116*26.89) =3119 Rs

- Labour cost for 1 column   =Rs. 125
- Erection cost for 1 column   =Rs. 46

- Total cost required for 1column
- Concrete=3119 Rs
- Steel cost=35*43(Rate/KG)   = Rs. 1505
- Labour cost   =Rs. 125
- Erection cost   =Rs. 46
- Total column cost=Rs. 4795
- Total no of column is 9
- Total cost   =4795*9= Rs. 43155
- 1cubic feet Rate for column =Rs. 178.31

B. PRECAST BEAM FOR M25 GRADE: -

1. Total volume of Beam =1.64X1.64X7.25= 19.49 cubic feet
- Steel required = 30 Kg
- R.M.C rate for 1 cubic feet concrete   =Rs. 116
- For 19.49 cubic feet concrete cost   = Rs 2260.84
- Steel cost=30*43(Rate/KG) = Rs 1290
- Labour cost =RS 125
- Erection cost = Rs 46
- Total Beam cost = Rs 3721
- Total no of Beam is 6
- Total cost =3721*6 =22326 Rs
- 1cubic feet Rate for beam =Rs 190.95

2. Total volume of Beam =1.64X1.64X13.5 = 36.30 cubic feet
- Steel Required = 30 Kg
- R.M.C rate for 1 cubic feet concrete =116Rs.
- For 36.30 cubic feet concrete cost = Rs. 4210.8
- Steel cost=30*43(Rate/KG) = Rs. 1290
- Labour cost =Rs. 125
- Erection cost =Rs. 46
- Total Beam cost = RS. 5671
- Total no of Beam is 2
- Total cost =5671*2 =Rs. 11342
- 1cubic feet Rate for beam =Rs. 156.22

3. Total volume of Beam =1.64X1.64X10 = 26.89 cubic feet
- Steel required = 30 Kg
- R.M.C rate for 1 cubic feet concrete =Rs. 116

C. PRECAST PANNEL FOR M25 GRADE: -

Table No: 1 (PRECAST PANNEL FOR M25 GRADE)

Sr. No.	Size	Reqd. No's	Cost per panel (Rs)	Total cost (Rs)
1	7.25X10X0.5	4	2900	11600
2	13.5X10X0.5	2	5400	10800
3	10X10X0.5	3	4000	12000

4	5.6X10X0.5	1	2240	2240
5	5.5X10X0.5	2	2200	4400
6	8.5X10X0.5	1	3400	3400
		13		**44440**

D. TIME SAVINGS IN CONSTRUCTION

Table No: - 2 (TIME SAVINGS IN CONSTRUCTION)

Sr. No.	On Site Activities	Duration
1	Transportation of column and beam	11hrs
2	Erection of column	6 hrs.
3	Erection of beam	7 hrs.
4	Column level	4 hrs.
5	Half column grouting	3 hrs.
6	Beam level	4 hrs.
7	Slab erection	2 hrs.
8	Slab level	1 hr.
9	Spreading silicon oil over slab	3hrs
10	Erection of rakers	2 hrs.
11	Slab reinforcement (mesh and all rend)	5 days (40hrs)

IV.   RESULTS AND DISCUSSION

A. Overall Time Comparison Between Conventional Building and Precast Flat panel system Building: -

Table 3: Conventional Building

SR. NO	DESCRIPTION	TIME
1.	Sub Structure - (Site cleaning, Earthwork, Foundation, Basement, Soil filling& Consolidation)	30
2.	Super Structure – (Wall panels framing and Roofing slabs.)	70
3.	Finishing Works – (Electrical, Plumbing Painting, Tiling, and Windows, Extra items)	30
	TOTAL TIME	130

Table 4: - Precast Flat panel system

SR. NO	DESCRIPTION	TIME
1	Sub Structure - (Site cleaning, Earthwork, Foundation, Basement, Soil filling& Consolidation)	30
2	Super Structure – (Wall panels framing and Roofing slabs.)	25
3	Finishing Works – (Electrical, Plumbing Painting, Tiling, and Windows, Extra items)	30
	TOTAL TIME	85

B. Overall Cost Comparison Between Conventional Building and Precast Flat panel system: -

Table 5: Conventional Building

SR. NO	DESCRIPTION	COST
1	Sub Structure - (Site cleaning, Earthwork, Foundation, Basement, Soil filling& Consolidation)	152675
2	Super Structure – (Wall, framing and Roofing, slabs.)	287160
3	Equipment	40000
4	Finishing Works – (Electrical, Plumbing Painting, Tiling, and Windows, Extra items)	231508
	TOTAL COST	711343

Table 6: Precast Flat panel system

SR. NO	DESCRIPTION	COST
1	Sub Structure - (Site cleaning, Earthwork, Foundation, Basement, Soil filling& Consolidation)	112375
2	Super Structure – (Precast Flat panels, framing and Roofing slabs.)	278210
3	Equipment	25000
4	Finishing Works – (Electrical, Plumbing Painting, Tiling, and Windows, Extra items)	133208
	TOTAL COST	548793

In the above analysis clearly states that the direct cost and time required for precast construction is very less in case of conventional constructions. This is achieved by keeping production unit near to the site, repetitions of form of buildings demands indirectly for the same mould to use again and again, which in return reduces the Building.

V.   CONCLUSION

- As we have seen various methods & research for Precast & Design, case studies for Precast & it is found that, it is found that it can be Economical than traditional if executed in proper way.
- It is been identified that the Duration & Cost of Building significantly reduces by precast building.
- From all this Research we can conclude that the Precast Concrete system is economical than conventional cast in place method.
- But some conditions are there in which we need to take care while using Precast in scenario like Manufacturing unit Distance from site. Building Type etc. The Standard & Repetitive work precast is the best option to choose.

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