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Analysis of Cost Effective and Energy Efficient Residential Building Using BIM – Literature Survey

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Abstract - *This paper is based on a review of research that describe user experience with different type of energy efficient residential building there is general perception among the users and researchers that energy efficient building are more economical than conventional building these days energy analysis is becoming more important factor to be considered because of worsening global warming and lack of energy sources when energy analysis is started from the conceptual designing phase of any building, it is the most useful as the designing is in its most flexible stage and many changes can be saved. In previous years these analysis takes too much time but now analysis can be done very fast with the help of building information modelling the effective use of energy analysis can be done and to understand the cost management aspect is also discussed. This paper is the study of literature done on analysis of cost effective and energy efficient residential building using BIM.*

Key Words: Energy Efficient Building, Autodesk Revit, Economical construction, Building Information Modelling (BIM)

1.INTRODUCTION

Economy is the major factor in any type of construction work, especially for residential building and more specifically when they are situated in the mega city in a developing country like India.

There is a need of concentrating on a sustainable light weight structure, which is one of the most important and one of the most discussed topics throughout the globe, at the age of global warming and climate change worldwide.

In this era, some middle way is necessary to be found out, to encourage the energy efficient Construction. Sustainable buildings are characterized as those providing the required building performance over the building life-cycle whilst minimizing consumption of non-renewable resources of energy and materials. However, the assessment of new buildings covers only performance aspects from the initial planning stage through to building site completion. Actual efficiency in performance during building use depends on what has been achieved in terms of improved design and construction quality. Sustainability is the need of time, the word may be used in buildings, projects, towns, cities, traffic and transport etc. Sustainability is the term used for modern technology and efficient methodology used for saving and conserving energy and increasing efficiency, it may be in the form of fuel, electricity or other means. While designing the sustainable building, understanding of thermal energy performance of roof and wall is important. The main aspects of the design of thermally comfortable residential buildings are minimizing the flow of heat & reducing wall & roof surface temperature under summer conditions. Up to certain extent indoor thermal environment can be controlled by proper design & planning of building components in relation to the climatic conditions. In this analysis, data on thermal energy performance of the building sections has been provided. This will enable the Engineers to choose proper material like AAC blocks, A.C. sheets, Green concrete and many more to improve thermal environment in building. By using energy-efficient and sustainable materials like AAC block, insulating spray foam, etc., are replacing with clay bricks and plastering mortar, This will make building energy-efficient and it's being economical. We use lightweight material it will reduce the size of columns and beams and reflects in a reduction in overall concrete use will reducing its construction cost.

2. OBJECTIVE

To develop cost-effective and energy-efficient building model using sustainable construction products and compare it with conventional building using Building Information Modeling.

3. LITRATURE REVIEW ON ANALYSIS OF ENERGY EFFICIENT BUILDING

3.1 Verma Tanuj et.al. (2016) says due to growing demand for floor space and emerging service industries and urbanization India expects amultiplying of floor space by 2030 use of low consumable energy and cost effective building material in this industry We can reduce the overall energy consumption significantly and thus significantly minimizes energy consumption of buildings in residential buildings and small commercial buildings over 40% of energy loss is related to we had a case through building components and Through heat transfer. Verma Tanuj et.al. 2016 suggests that various alternative buildings materials their evaluation and production based

on three components that is first thermal second is carbon dioxide and third is embodied energy. We can make building energy efficient by minimizing these three components

3.2 S.K. Gupta, Nishant Nathani et.al (2011) Observed that thermal condition of outdoor and indoor can be measured for the human comfort. We can control the inside comfort level by thermal material but we cannot control outdoor comfort level because artificially made things can only be controlled by humans. Indoor conditions up to certain level can be improved by doing adjustments in building components optimum orientation and proper selection of ventilation location and sizes recently such artificial materials are available which can be control the thermal efficiency.

3.3 Karlsson et.al. (2006) Has investigated the thermal climate and the space heating in 20 degree low energy residential building in South of Gothenburg Sweden They have taken interviews with the occupants as well as taken measurements physically the heating system in the terrace house is based on emission of body heat of occupants and solar radiations people agree that the heating system function well but during winter time when the heater is working indoor temperature get vary. This study shows that experiment with heating up the house buying opening doors and lighting candles when the house is empty it takes a lot of time to warm it up therefore some off resident peoples blow heating on when they ar not living there. The main difference between the major indoor temperature and the residents get experience of the temperature. The indoor temperature was higher than expectations indicating that subjected to experience differ from place to place and person to person.

3.4 Leaman and bordass et.al (2007) studied of the difference between stakeholders satisfaction on green occupational buildings and conventional occupational buildings shows that users tend to have a higher tolerance for deficiencies in green occupational buildings then in more conventional occupational buildings user seems to tolerate more discomfort in a green building the more they know about how the building is supposed to handled and how they can use for example window controls Residents are much less satisfied when they cannot understand how things work and how to control temperature and ventilation.

3.5 Paul and Taylor 2008 For instance, conclude that their study revealed insufficient proof to support the hypothesis that green building are perceived as more comfortable than conventional building. They measured residents' level of comfort and satisfaction in the three university buildings in Australia one green building and two conventional buildings. After survey they found no evidence that the green building is received more comfortable than the conventional building the aspects of lightning ventilation and acoustics, were not perceived differently by the occupants of the two types of buildings.

3.6 brown and cole 2008 compared occupants in a conventional building and an energy efficient building in British Columbia. They found that user in the energy efficient building where more interested in learning how the building and its control works. However, while occupants who knew more about their buildings inner workings use the controls more properly and extensively,they did not report higher degrees of perceived comfort. thus, even though some aspects like knowledge and learning are central for a well-functioning energy efficient buildings end should be more improved through easy to use controls and appropriate guidance, there are other factors at play role. furthermore, occupants have more expectations towards energy efficient buildings.

3.7 Sanghasheel Ghodeshwar, Mukesh Pandey, Rakesh Gupta et.al (2019) Their research is dealing with the energy and comfort issue in residential and real estate sector without affecting the nature. challenge is the planet facing various problems like global warming, environmental contamination, air pollution, depletion of resources of energy, due to increasing amount of carbon element in nature which helps in reducing the energy resources end of its human health. Building itself contained more than 40% of energy stored, 30% of nature resource 20% of water stored, also 40% of carbon dioxide emission and produce 30% of solid waste. Authors concerned about energy and atmosphere sustainable buildings, indoor environment quality, water efficiency, materials and resources with acquiring techniques like proper designing aspects and orientation using energy efficient materials and utilizing them in a proper manner insulation with maximize the use of renewable resources and achieve higher manner to save energy.

3.8 A. S. Shivasharan, Mrs. D. R. Vaidya, Prof. R. D. Shinde et.al. (2014) energy analysis of building is becoming an important factor to be considered in architecture engineering and construction industry these days because of worsening of global warming. The energy analysis of building needs to be integrated into the design phase of building with respect to increase the regulations required all over the world. Forecasting the energy consumption of the building and using a suitable energy conservation measures and design for construction of building is a need of the hour. their research is based on the autodesk building information modeling capabilities to perform and energy analysis of residential building this seeks to find and help to integrate the use of building information modeling energy analysis result in the predicting the energy consumption of building this will further help in to maintain any major variations, step two saving energy uses or avoiding wastage of energy can be done with the

help of energy analysis results. For this purpose, Revit software end building information modelling is used.

3.9 Abhilash Jangavle, Vijayratna Kamble, Shivraj Gawandi, Nirali Ramani et.al. (2017) They observed that the use of building information modeling technology along with the green building service in revit energy analysis of residential building can be done easily. Energy analysis of residential building reports generated in Revit along with green building studio or inside 360 gives the more accurate and graphical representation of data. The energy analysis of building report consists of detailed graph and diagram of various energy parameters like carbon dioxide emission and wind wind speed diagram, energy consumption and fuel consumption, heating and cooling, Load charts etc. Which will give us clear ideas for designers to analyze building orientation and energy requirement parameters.

??. REVIEW OF COST-EFFECTIVE RESIDENTIAL BUILDING

4.1 Michael Rehm, Rochelle Ade et.al. (2013) The actual construction cost of certified green buildings in New Zealand is compared with conventional buildings. Although a large body of research exist on the financial economic and environmental benefits of green buildings, there is little proof on capital cost implementation for green building. Research serves as the first empirical study to analyze detailed cost plan data in New Zealand city to qualify the impact of green building on construction cost. Data from 17 green star New Zealand V1 certified office building where paired with a set of modeled cost estimates received from the Davies leg on blue book and the Rollins New Zealand construction push stop the paired data were analyzed across 5 panel of using the non parametric Wilcon Mac Paris signed rank test. When benchmarked again the murdered cost, green building construction cost were higher than average, but difference was not statically significant. This was true across all five panel tested the entire green office building data set mid rise buildings, high-rise residential buildings, four green star rated buildings and five and six green star rated buildings. Each panel featured buildings that were above comparative cost as well as several whose actual cost where below modelled estimate.

4.2 Vishnu Vijayan, Akhil S. Raj, Merin Mariam Varghese, Sona L. Panicker, Deepu Mohan et.al. (2017) Authors have done research on cost effective construction materials and technologies in rural sector. The basic needs of everyone is in this world is shelter. but not everyone has the sufficient economically strong to construct their own dream home and have some limitations. Nowadays increase in the cost of construction material is a big issue that we are facing in our society and in daily life, that is due to lack of natural resources. India is developing country so various building constructions are taking place in our country day by day and various researchers are now conducted in several places to make building construction economical. While constructing a residential building we must aware about the safety of environment by protecting more eco-friendly construction in our world so that we can maintain sustainability. We are all highly dependent on non renewable energy resources for various construction in industry, so natural resources become vanish and due to its demand cost is increasing as a result. There should be an end in the increase in the cost of construction industry to keep sustainability by using sustainable and economical construction materials. To reduce the cost of building construction in the housing sector by adopting innovative techniques and sustainable materials. By using these innovative ideas, we can make greater contribution in economy of construction industries. This can be done by the data collection from the selected jurisdiction area studying, preparation of cost effective plan, nearest sources of materials, comparison of cost effective building materials and techniques, inventory of cost effective buildings.

4.3 Tushar jadhav, Eshwar Pandalaneni, Bhargav Kandula, Eesha Thakre et.al. (2016) Energy efficient residential buildings have gained a lot of significance in these recent years due to more emphasis on energy conservation. There is a general perception among the users that energy efficient building will always have more initial cost as compared to conventional buildings. This research compares the initial cost of major elements such as building envelope components, mechanical and electrical systems war conventional building end energy efficient building. The effective use of building information modeling is to understand the cost management aspects. The findings of the study indicate that the initial cost of energy efficient residential building can be significantly economical as compared to the conventional building. This research also highlights the effective use of building information modeling estimate the major cost drives associated with in the building. The plan for comparative initial cost analysis between conventional building and energy efficient building can be provide significant insights to different stakeholders in promoting energy efficient buildings.

4.4 Dr. M. B. Kumthekar, Ar. Akshay A. Wayal et.al. (2012) Studied mainly emphasize on implementation of Aerocon Blocks and panels in today's situation cost effective and speedy construction. Cost effective speedy construction should be possible by utilizing of proper planning and project management, low-cost sustainable materials, economical construction, innovations and alternative construction techniques and strategies accessible. The selection of building materials should address the issue of nearby source conditions to enhance estimation of life for The Wanted ones by building innovative structures or by refining existing building structures. Many studies have

demonstrated that different materials have been utilized in various types of building frameworks with conventional and current modern strategies, however just few of them have effectively been executed in low-cost construction of building projects. The present time of land has aged and play bricks and mortar are replaced with new alternative development materials like Aerocon blocks end panels. These blocks are lighter than conventional bricks and more economical alternative.

4.5 Shweta O. Rathi, P. V. Khandve et.al. (2018) Studied burn clay brick is a predominant construction material used in building construction. The carbon dioxide emissions in the brick manufacturing process had been acknowledged as a significant factor to increase global warming from industry. Therefore, nowadays we should focus on seeking environmental solutions for green environment. To fulfill this objective, new construction materials can be used for building construction this research highlights the comparative analysis of cost effectiveness of using AAC blocks instead of conventional red bricks. The usage of ACC blocks gives a prospective solution two construction industry along with the environmental preservation.

4.6 Kamlesh Dhone, Aditya Agrawal, Shakti Sagar Pandey et.al (2019) Floating concrete is one of the sustainable composite materials which contains both physical and chemical properties and composed of cement, water, aggregate, sand and various types of admixtures. generally, the density of ordinary Portland cement as per Indian standard 456 is 2400 - 2500 Kg/cm3. and the density of floating concrete is very light as compared to normal and it ranges in the range of less than 1000 kg/cm3. The main aim of this research is to introduce these various types of new mixtures with their different compositions and check the results for the maximum strength by doing compression test. The use of floating is used to reduce or minimize the dead load of the structure of building which reduced the overall cost of the building project. In this research the use of thermal walls can be introduced for the construction of lightweight concrete due to the less density than water it will float on the surface.

4.7 Vaibhav Helonde, Yuoraj Deshmukh, Vajid Sheikh et.al. (2008) AAC blocks are lightweight aerated autoclave concrete block. It is manufactured reaction of aluminum powder blend of lime in a proportionate manner, cement fly ash and sand. AAC block is a missionary material that is very lightweight and easy to construct and economical to transport due to its lightweight. The usage of AAC block reduce the cost of construction up to 30%. The weight of auto calved aerated concrete is much lesser than the infill wall.

4.8 Mohammed Shihasv et.al. (2020) construction industries in India are extremely using various types of materials such as hollow blocks, concrete blocks, bricks etc. for partition wall and infill walls. these blocks are bulk in weight and have more transportation issue. This research aims at the practicing of cellular lightweight concrete using fly ash, synthetic foaming agent,cement. Mix design was prepared with cement to fly ash in ratio as 2:1, 1:2, 1:1, followed by water curing. Experimental investigation was performed on these mixes with respect to density, compressive strength, water absorption, fire resistant, in addition to extreme environmental conditions. The results indicated that foam concrete blocks and panels can be used for separation wall, infill purpose with improved performance and other characteristics.

5. CONCLUSION

The authors can acknowledge any person/authorities in this section. This is not mandatory. Energy analysis is important factor in structural engineering in vision to make suitable changes at designing level and to achieve occupants thermal comfort. Energy efficiency can be achieve by replacing conventional material with sustainable material which have better properties than conventional material. This light weight material will indirectly reduce sizes of structural component like beams,columns and it will save concrete and reinforcement in using and also will save the cost of construction as compare to construction of conventional building.

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