ENERGY ANALYSIS OF A HOUSE USING REVIT 2016

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Abstract: As the advancement in technology has progressed over the years, traditional method of providing thermal comfort in structures has been neglected. To reduce the running cost of the appliances, a onetime cost in the form of optimum construction is necessary with respect to cost and environment benefits. Use of air conditioning, heaters, coolers, etc consumes large amount of energy. Therefore, it is necessary to adopt ways to reduce the consumption of power. This can be obtained by using elements such as thermal insulation, thermal mass and by replacement of glazing type, variation in overhang shade and window sizes, etc with respect to a modern base case construction. This can be achieved by using a thermal analysis tool to analyze the differences in degree hours for discomfort, reduction in temperatures, etc. We with tried to merge modern industrial aspect with traditional one. To achieve this we have used the software ‘ REVIT 2016.

Keywords: Sustainability, Energy Efficiency, Thermal Comfort, Revit ,Green Housing.

I. INTRODUCTION

In this project, a brief description about climatic zones, climatic city, climatic temperature, comfort zones and the factors affecting climate are given. As buildings are constructed for human beings these factors are necessary to be taken into consideration while designing a structure to maintain a certain level of comfort. The human body is affected by adverse temperature, heat and cold therefore the concepts of heat transfer and desiccant cooling are important while constructing any residential or commercial building. Due to technological advancement the concepts of heating and cooling became less important due to the dominance of technologies such as the electric fan, air-conditioning, and heaters etc. But it came at a price of high energy usage which in turn increases the cost. Therefore it became imperative to use materials which suited the comfort temperature inside with respect to the outside weather. Achieving comfort in building starts with the knowledge of the climate in question and passive strategies to control this climate in order to provide the right design approaches for maintaining comfort. The selections of site, orientation of the building, vegetation, choice of thermal insulation for the particular climate, as well as selecting the building materials for thermal comfort are the major and prime controls in maintaining thermal comfort of the structure.

II. LITERATURE SURVEY

Ikbal Cetiner , Andrew D. Shea (2018) Current insulation materials in the construction market, which are predominantly inorganic materials, have a high performance in relation to heat transfer, i.e. high R-values, but the environmental impacts in their production processes are significant. In this study, natural fiber material in the form of wood waste is examined experimentally to assess its suitability for its use in thermal insulation, without the addition of any binder,and within a timber frame wall construction.

Alfonso Capozzoli and Stefano Fantucci el at (2015) did a study on the critical issues related to the laboratory measurement of the equivalent thermal conductivity of VIPs and their performance degradation due to vacuum loss has been carried out utilizing guarded heat flux meter apparatus. A numerical analysis has also been developed to study the thermal bridging effect when VIP panels are adopted to create a multilayer board for any building applications.

Fayez Aldawi (2013) primary objective of this study is to investigate several new house wall systems using various construction materials in order achieve higher thermal efficiency for ongoing heating and cooling. The thermal energy performance modeling for two current and four new house wall systems was undertaken for varied climate conditions across Australia. The findings revealed that a new house wall system can provide higher energy efficiency and also a consequent reduction of greenhouse gas emission for major locations in Australia.

Kaushik Biswas (2018) High-performance thermal insulation is a critical necessity for buildings. The article presents the development and thermal characterization of composite foam insulation boards consisting low-cost vacuum insulation cores. The composite foam-vacuum insulation boards were created in a semi-automatic operation in a foam insulation manufacturing plant. The low-cost vacuum insulation is a latest technology called modified atmosphere insulation.

III. METHODOLOGY

The prima facie is to study and determine whether the traditional materials are more conducive in providing thermal comfort to the occupants in a building than contemporary ones. The thermal environment encompasses of all those characteristics of the environment which affect the heat exchange of the human body. The questions were "How can one ensure the thermal comfort for the occupants of a building? And, "What is the role of the materials in defying the thermal comfort?". The research is aimed to reduce the consumption of energy inside the building or structure by maintaining comfort levels . The research is mainly focused on to compare the cost required for typical structure constructed in Kandivali , Mumbai which are constructed followed by assigning all factors of comfort, temperature and material optimization. We designed a G+1 structure with traditional materials as shown below. The study is mainly based on analysis done by software called Autodesk Revit 2016.

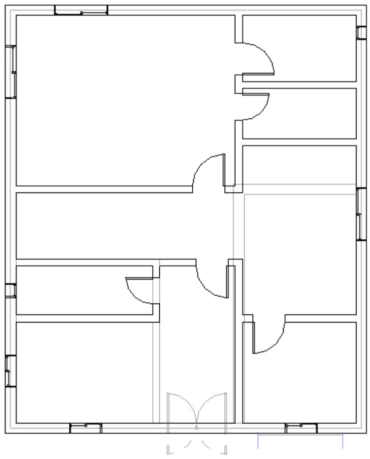


Fig.1 First Floor Plan

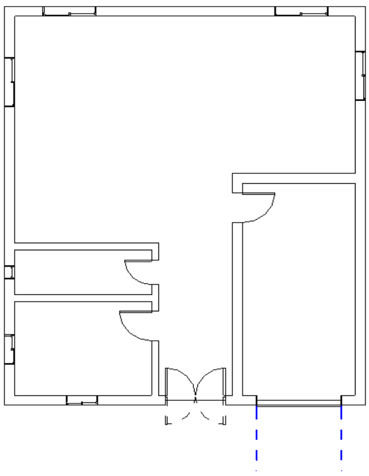


Fig.2 Ground Floor Plan

The next step is to create an energy model which is shown below:

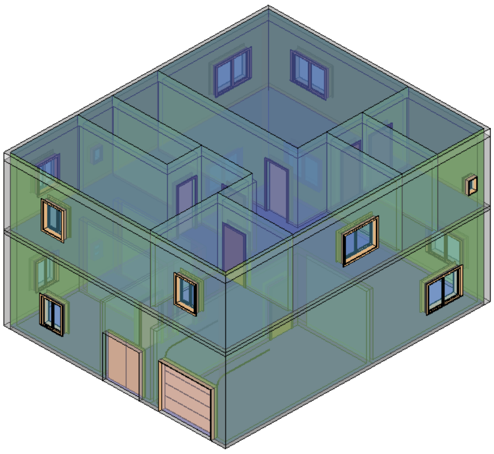


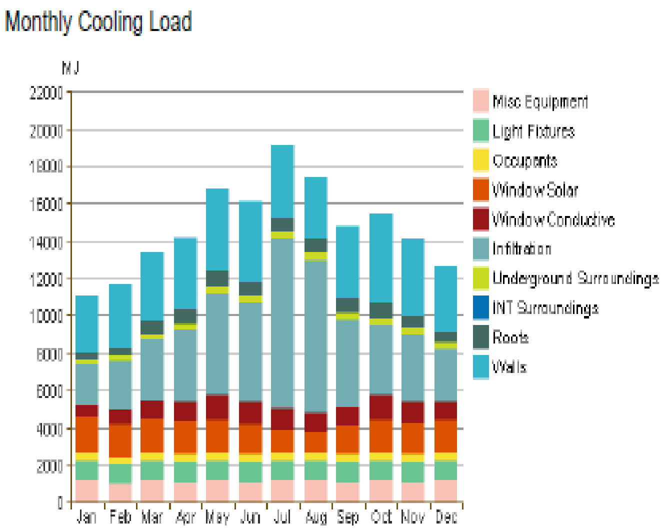
Fig.3 3-Dimensional View

After creating an energy model we generate an analytical model and potential performance outcomes with insight. It determines Energy Cost Range and Factor Sensitivity. It also provides us with information regarding life cycle energy cost, energy usage intensity and annual carbon emissions. Insight helps us demonstrate potential performance outcome based on a range of different design scenarios. The materials used for different components in case of traditional as well as contemporary are given bellow in table:

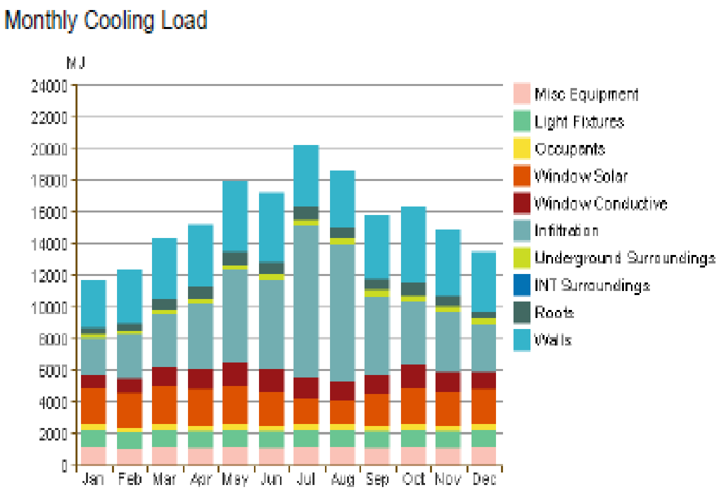
COMPONENT	TRADITIONAL	CONTEMPORARY
Exterior walls	Concrete cast 0.30m with gypsum finish of 0.10m.	Concrete cast 0.30m, rigid insulation 0.01m, gypsum substrate coat 0.10m.
Interior walls	Brick block 0.20m with gypsum finish 0.10m.	Brick block 0.20m, air gap 0.01m, and gypsum finish0.10m.
Roofs	Concrete cast 0.1750m, concrete substrate 0.05m, roofing tiles 0.038m.	Concrete cast0.1750m,concrete substrate 0.05m,rigid insulation0.20m,asphalt layer 0.02m, rigid insulation 0.05m and finishing with roofing tiles 0.038m.
Window Glaze	Single glazed.	Double glazed.

IV. RESULTS

With the analyzing tool REVIT the results obtained were particularly different for traditional and conventional materials. Changes were observed in the results of traditional and conventional material though in contemporary material only extra rigid insulation layer were added and the base layers were kept the same as in traditional materials. As the base layers were kept the same minor differences in the analytical results were found.

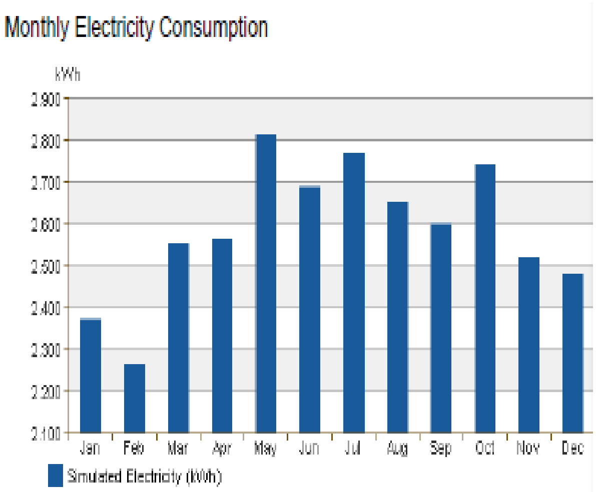


For Contemporary Materials

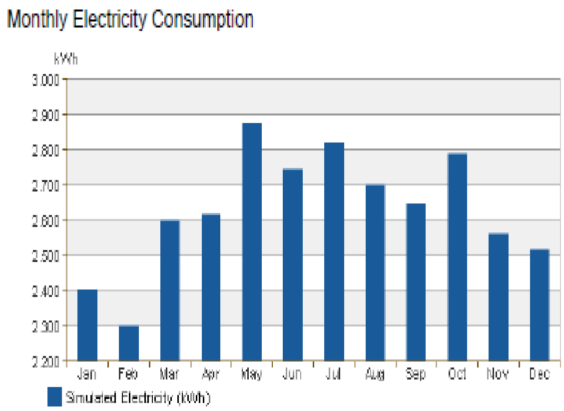


For Traditional Materials

The monthly cooling load of the structure with contemporary materials was found to be less than the traditional materials. This was because of the rigid insulation provided in the exterior walls and due to the change in the glazing panel of the windows. The glazing type was changed from single glazed window to double glazed window .As the cooling load is decreased it will in turn decrease the annual energy usage and making the contemporary materials more conventional and energy efficient.



For Contemporary Materials



For Traditional Materials

As in the above bar graphs it is clear that the total electricity consumptions by traditional material in higher than the contemporary materials. The total units of energy consumed by the traditional materials are 132 kWh/sm/yr of electricity EUI and 29MJ/sm/yr of fuel EUI as per the analytical report. Whereas the total units of energy consumed by contemporary materials are 129 kWh/sm/yr of electricity EUI and 27 MJ/sm/yr of fuel EUI.

Life Cycle Energy Use/Cost for Contemporary material:

Life Cycle Electricity Use:	930,462 kWh
Life Cycle Fuel Use:	219,143 MJ
Life Cycle Energy Cost:	$19,985

*30-year life and 6.1% discount rate for cost

Life Cycle Energy Use/Cost for Temporary material:

Life Cycle Electricity Use:	946,952 kWh
Life Cycle Fuel Use:	209,143 MJ
Life Cycle Energy Cost:	$20,337

*30-year life and 6.1% discount rate for cost

V. CONCLUSION

- Change in the type of window glazing significantly changes the comfort factor in a structure.
- Air gap provision in interior walls will substantially reduce the heat transfer in the structure.
- Use of contemporary materials is effective because it reduces the average annual energy consumption level as compared to traditional material.
- The annual running cost of the structure is also reduced by providing thermal insulating materials .
- Hence, it can be recommended to use contemporary type of materials for building construction.

VI. REFERENCES

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