

# APPLICATION OF CONCEPTS OF GREEN BUILDINGS TO A HOSTEL

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## I. Abstract:

According to data given by the World green building council buildings and construction sector accounts for 39% of the energy related emission in the world. In this project we have designed a hostel and some its components by applying the concepts of green buildings and new emerging green technology and we have done physical model of the building using the foam board. We have done site and landscape planning in such a way that is sustainable and efficient during construction and operation of the building. The design strategies adopted in planning ensures minimal disruption of the site and maximum usage of microclimatic features. We have used Auto Cad and Revit for preparing the plan and 3D model of the building respectively. The green components include the stack ventilation, double glazed windows and multi layered roof. These components provides good ventilation to the building, maximum utilization the sunlight during the day time and helps in keeping the temperature normal during the summer. The use of solar panels (PV cells) and rain water harvesting helps in reducing the energy and water requirement of the building and other advantages include

- Enhanced indoor air quality
- Good health & well-being of the students
- Reducing waste, pollution and environmental degradation

Key words: Sustainable development, Green building, Stack Ventilation, Auto Cad, Energy Efficiency, Revit, Griha.

## II. Field Studies:

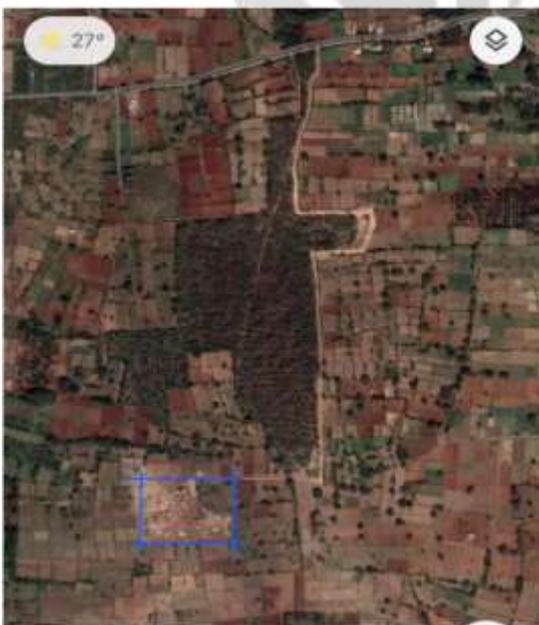


Fig 1 : Site location

- The site is located in Maragowdanahalli, K R Nagar, Mysore.
- The area covered is 40044sqm.
- The annual rainfall in this area is 776.7 mm. The elevation of the site is 778 m from the mean sea level.
- The coordinates for the area is 76.2868E , 12.4134N .
- The main road is located at 500 meters from the hostel, The nearest bus stop is Maragowdanahalli gate which is 750 meters far from hostel.
- The carpet area used is 698.45 sqm.

### III. Designing of Green building Components:

**1.Stack Ventilation:** Stack ventilation techniques inherited from vernacular architecture worldwide which are still in use today. Among the most common techniques are the static type openings on the top or upper part of the building like ridge, static and dormer vent, chimney flue, jack roof. In some conditions, these static types of ventilation strategies could be enhanced by the use of atrium, stack devices and ventilation shafts. An open to sky design in our building which is usually incorporated in the middle of a deep plan building for both daylighting and ventilation purposes.

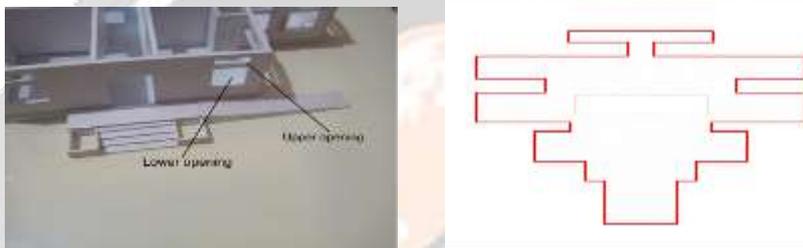


Fig 2 : Stack ventilation strategies a) opening at sill level b) open to sky structure

**2.Double Glazed windows:** Double-glazed windows have two panes of glass fitted into a window frame. An inert gas like argons is filled between the two panes to increase insulation. Double glazed glass is prefer for Indian weather conditions. The window panes not only provide relief from extreme temperatures outside, but also insulate your space from the noise outside.



Fig 3 : Typical Double Glazed window

**3. Multilayered roofing:** The multilayered roofing consists of thermal and water insulating layers. The multilayered roof involves placing the slates with overlap in order to create roofing imitating wooden shingles. Known methods of making roofing involves separate placing of subsequent layers of roof i.e. the thermal insulation layer which consists of one or several layers of polystyrene foam, different kinds of foam, different layer of which may be covered with underlay tar paper and a layer of water insulation consisting of one or several layers of covering materials, especially tar and paper.

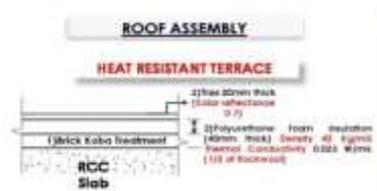


Fig 4 :Typical Roof Assembly

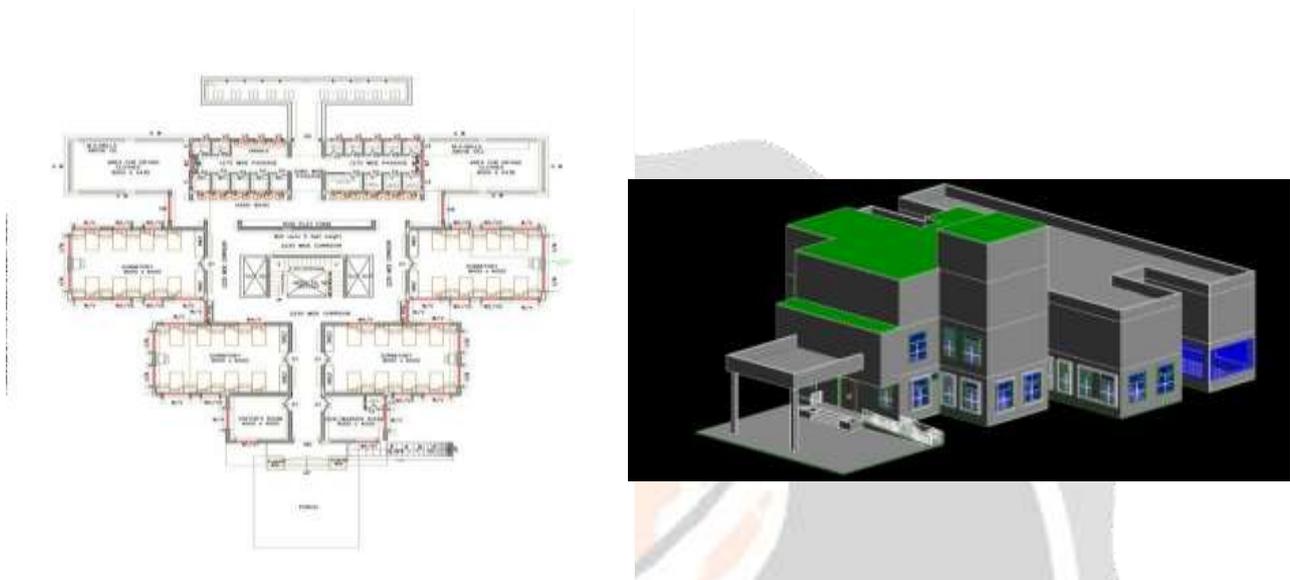


Fig 5: Plan and 3D Elevation of the hostel building

#### IV. DISCUSSION:

The advantages of components are:

##### 1.Stack ventilation:

- It works 24 hours a day without energy.
- Maintenance and running costs in the system is almost zero.
- It does not need any supply of electricity and it is the most energy-efficient ventilation system.
- Installation is much easier than other methods, while you don't need any mechanical instruments or heating recovery systems.

##### 2.Double glazed windows:

- It keeps room warmer in the winter.
- It keeps room cooler in the summer.
- It enables lower energy to heat or cool the room, so lit results in energy cost savings.
- In addition to maintain heat or cool in the room, It provides safety to the room due to doubled glazed windows compared to normal windows.

##### 3.Multi-layered roof:

- Simplification of the roofing construction by creating ready-made multi-layered roofing elements whose position is prepared base and their interconnection allows obtaining roofing which ensures full thermal and water insulation.
- Reduction of costs by making roofing in the place where it will be used.
- Reduction of works connected with using open fire during the assembly of elements.

- Suitability both in case of making new roofing and renovating old ones

#### DESIGN CONSIDERATIONS:

1. Each room is subjected to 3-side exposure, as it allows us to keep more windows for light and air circulation, as shown in below figure 1.
2. Parallel windows for better air circulation in the room, as it is enabled by 3-sided exposure criteria, as shown in below figure 2.

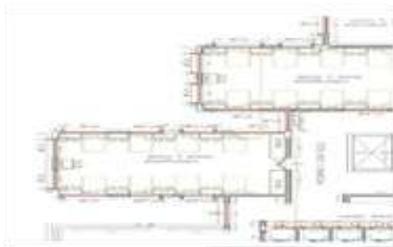


Fig 1: Three side exposure

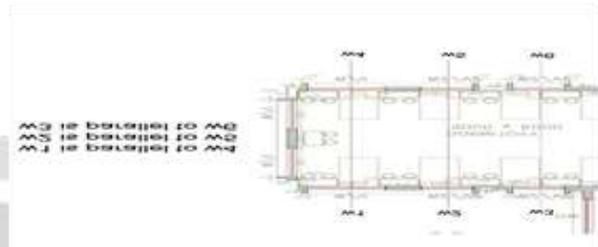


Fig 2: Parallel windows

#### V. Conclusion:

For the conclusion, this project describes the various eco-friendly components to form a net-zero energy building in terms of light, ventilation, water supply and various factors which accounts for the compatibility of the building with the cost effectiveness over normal building. This project involves Griha criteria, as these criteria is applied using various components to get proper Griha ratings.

To get the net-zero energy building one of the key components is lighting. In this project lighting of hostel rooms is done using sunlight as the main source as this allows saving maximum electricity. The basic study involves building direction, design of building to get maximum sunlight and placement of windows which allows maximum sunlight, as windows have to be designed with eco-friendly materials and also it should be cost effective. And the material used in the component such as windows also plays a vital role in lighting. This also involves design of rooms in such a way that each room is subjected to three-sided exposure to the daylight as it reduces daytime electricity and also open to sky in the middle of building enables maximum daylight in the corridors as it is included in the planning.

Another component is ventilation as it also plays vital role in attaining net zero energy. As this project involves stack ventilation as it ventilates the whole building as it has been enabled by building design. This stack ventilation is one of a kind in eco-friendly components as there are many other components which can be used for good eco-friendly ventilation. In addition to this a design criterion can also be used i.e., placing parallel windows as this reduces abstraction of air flow, as stack ventilation alone is not going to satisfy overall ventilation. This project has involved multiple components for lighting and ventilation, as it is always good to have multiple components for a single purpose to attain effective lighting or ventilation. Another component is double glazed windows which can also be used in hot areas as it has very low heat transmittance as it can also satisfy lighting category.

Revit software is also been included in this project, as design and planning are vital in constructing a green building. 3D modelling with 360-degree view has been done using Revit for this project. As this is done to provide addition aesthetical appearance of the building. It provides eco-friendly designs i.e., paperless designs.

## References

1. "Sustainable Design And Energy Consumption Analysis For Structural Components" ,joseph M. Danatzko, Halil Sezen and Qian Chen:2013
- 2."Energy Embodied In, And Transmitted Through, Walls Of Different Types When Accounting For The Dynamic Effects Of Thermal Mass", Aidan Reilly, Oliver Kinnane, Richard O'Hegarty, Year:2020
3. "Water Permeability Of Exterior Wood Coatings: Waterborne Acrylate Dispersions For Windows", Štěpán Hýsek, Hakan Fidan, Miloš Pánek, Martin Böhm, Kamil Trgala,Year:2018
- 4." Delivering Green Buildings: Process Improvements For Sustainable Construction ",Michael J. Horman, David R. Riley, Anthony R. Lapinski, Sinem Korkmaz, Michael H. Pulaski, Christopher S. Magent, Yupeng Luo7 , Nevienne Harding & Peter K. Dahl,Year:2006
5. "From Low-Energy To Net Zero-Energy Buildings: Status And Perspectives ",Karsten Voss , Eike Musall, and Markus Lichtmen,Year:2011
6. "Adoption Of Green Building Guidelines In Developing Countries Based On U.S. And India Experiences",Varun Potbhare, Matt Syal, and Sinem Korkmaz,Year:2009
7. "Energy Efficient Systems And Strategies For Heating, Ventilating, And Air Conditioning (HVAC) Of Buildings,Moncef Krarti", PhD, PE,Year:2008
8. "Daylight Dividends Case Study: Smith Middle School, Chapel Hill", N.C:Dennis Guyon,Year:200
9. "Sustainable Design Has Changed Building Design, Ronald Mazza, P.Eng.,2007 9. Sustainable Design Has Changed Building Design Ronald Mazza", P.Eng. Year:2007
10. "Solar Architecture And Energy Engineering", Alexandre Pavlovski, Jim Fletcher, Vladimir Kostylev, and John Crace,2010