

PLANNING AND DESIGNING OF SUSTAINABLE BUILDING USING GREEN BUILDING APPROACH

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ABSTRACT

In this paper, Green building concept is used in planning and designing of sustainable building which conserves energy by using (Solar panels, efficient HVAC system, low energy consumption lighting fixtures), conserves water by using concept of (Rainwater harvesting, recycle and reuse of sullage water) and uses of eco-friendly construction materials, which results in reducing pollution, effect of global warming which is the alarming situation for the world.

Keywords: Sustainable Building, Solar Panel, HVAC System, Rain Water Harvesting, Construction Material.

I. INTRODUCTION

The Construction of Building has a huge effect on the environment, using about 40% to 45% of natural resources in industrialization, consuming nearly 10% to 12% of portable water and 65% to 70% of the electricity, and 40% to 60% of the waste disposed in the landfill.

These are responsible for emitting harmful gases like producing 30% to 35% of greenhouse gases (like Carbon dioxide (CO₂), Methane (CH₄), evaporation of water, and nitrous oxide). Simultaneously, the poor quality of the environment is the cause of health sector for humans and animals. There are many materials present in construction areas that emit a large amount of heat and carbon dioxide which is affected the environment. The poor quality of air inside the building causes health problems to employees. Construction of buildings consumes 40% to 45% of the sand, gravel, stone, and almost 20% of raw timbers. The building sector has a vital impact on the overall environment because a lot of resources are used for making a building.

Cooperative apartment houses represent a large percentage of environment materials selection and a suitable or necessary layout for sustainability appreciable steps have been taken out by research community worldwide in order to search for alternative sustainable building materials and cheapest technology methods that result in sustainable in affordable construction that suits in today's generation. Adaptation of green building materials is the right approach to meet the target. The selection of materials that have very less impact on buildings plays a nice role in the path of the country's development. So that's why the adaption of environment-friendly building products is an outstanding method to improve a building's environmental performance.

There are many new technologies that are coming in a chapter on making environment-friendly buildings. Many technologies have originated from the earlier influx of sustainable housing activism that develop in 1970s environmental movement. These are many strategies that referred to the effective spreading of ideas above the green building and many more. The main purpose of studying sustainable building materials is to explore more and more ideas to contribute to environment-friendly buildings, which can be less harmful to human beings.

II. DEVELOPMENT OF GREEN BUILDING

The green building approach plays a vital role in making an eco-friendly society. The implementation of these strategies saves resources, lowers the consumption of waste, and also improves the quality of the environment. These lead to social, economic, and financial benefits. Green buildings lead to saving operation and maintenance costs by using high-efficiency illumination and insulation system or using a suitable selection of materials, for example, rainwater harvesting. Green building advantages are related to the advancement of environmental quality inside the building and also lead to reducing the health cost and increasing the productivity of an employee. Furthermore, more benefits including buildings goodwill are considered.

Despite all these benefits green buildings are not recognized as an attractive project since most builders think, that making green buildings requires expensive materials and technologies like (Photovoltaic Panels, and greywater reuse systems) which increase the cost. Therefore, a careful selection of materials is necessary

rather than selecting an expensive technology, which may result to accomplish an ideal environmental objective at a cheaper cost. The achievements of green buildings will be depended upon the qualities and effectiveness of the sustainable system which is installed. Therefore, a market demands an approach to make a difference between conventional buildings and green buildings by using standard, transparent, objective, and verifiable green measures to ensure that the basic green requirements are achieved.

A. Building Materials Problem

In building, the selection of materials is very important. Many problems arise including environmental issues with the byproducts of materials that are used in buildings and there are a lot of limits on the extraction of resources in numerous amounts for making granulated blast furnace slag (GBS). By use of technology, we resolve the complication of resource depletion, corrosion, pollution, durability, lifespan, etc. that is related to building materials. And one thing that is always kept in our mind before making a building, is the selection of materials based on that can be easily recycled.

B. Materials Selection

- Clay fly ash brick – About 25% to 50% fly ash depends upon the soil quality that can be mixed to make burnt clay fly ash bricks by mechanized process.
- Stabilized Mud fly ash bricks – With the help of lime, cement, or other chemicals mud fly ash bricks can be easily made.
- Calcium silicate bricks – These bricks are a variety of commonly known sand-lime bricks using fly ash instead of quartz sand. The process involves high- or low-pressure compaction followed by a hydrothermal condition.
- Mixing with cement – About 20% dry fly ash mixed with clinker for manufacturing of cement or blind with Ordinary Portland Cement (OPC) to produce Portland Pozzolana Cement (PPC).
- Autoclaved aerated concrete (AAC) – It can be manufactured by a process that involves mixing fly ash, lime/cement, and gypsum in a high-speed mixer to form a slurry. These result in an excellent product for walling blocks.
- Cellular Light Weight Concrete (CLC) – It is simply manufactured by mixing fly ash cement. These are especially useful in high-rise construction.
- Sintered light weight aggregate – It substitutes stone chips in concrete for reducing the dead weight of the structure. It can be used for various purposes including lightweight concrete building units for use as load and non-load bearing elements.
- Cast-in-situ fly ash wall – By using high fly ash mix in this we can achieve nearly 20% economy, quicker construction, and a well-finished wall on both sides.
- Fly ash stone powder cement bricks – These are manufactured by mixing and mounted and pressed in bricks making machine.
- There are many materials like plyboard, bamboo, gypsum board, and other eco-friendly construction chemicals, etc.

III. STUDY LOCATION

The Proposed Expansion of The Sahara Estate Green Building Project at Tara Mandal Road – Gorakhpur, Uttar Pradesh. It is located near the southern extremities of the Ramgarh Taal area in Gorakhpur. - U.P. & at about 450 m SE of Tara Mandal and about 360 m NNE of Circuit House.

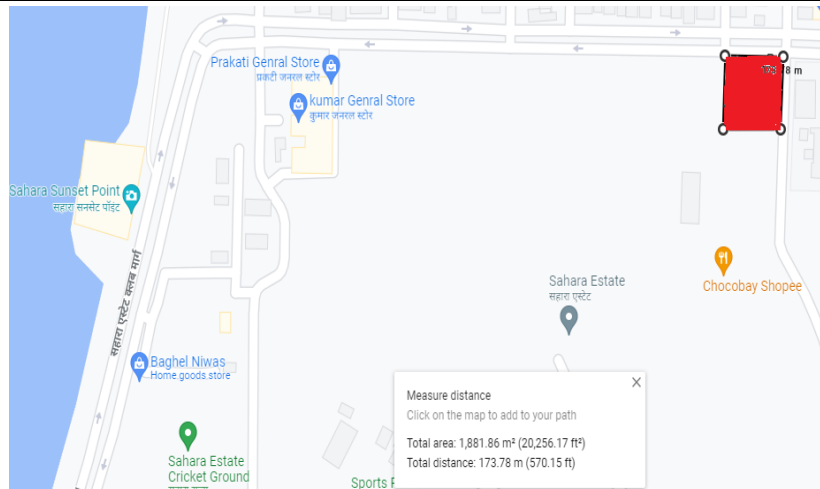


Figure 1: Study location Plot area on Satellite View

IV. IN RESULTS TECHNIQUES USE IN SUSTAINABLE BUILDING DESIGN

Water Conservation and Management – It is an important method that helps to keep water pure and clean. Many parts come under for making sustainable building design.

- **Rainwater Harvesting** – It is a concept that is used to collect and store rainwater for later use from clean surface such as roof, surface of land, or rock catchments. In this process we store rainwater from a clean surface then further filtering is done and then use for further process. It can be either stored in tanks or simply recharge groundwater depending upon our current situation. It provides high-quality water and reduces the dependencies on well, hand pumps, etc. Rainwater harvesting having components like a catchment(rooftop) to collect water, gutters to transport water, a first flush separator that separates the first rainwater, a rapid sand filter for rainwater filtration, a storage tank to store rainwater after filtration, and a delivery system to deliver the water for household works.

Design and installation of rain water harvesting system incudes —

- 1) Rain Water catchment and conveyance.
- 2) Rain Water storage and tank sizing.
- 3) Rain Water quality and treatment.

- **Water Reuse and Recycling** – It is a most important technique that is used in green buildings about 10,000 lit of water should be stored in building by which it can be reused and recycled again and again and also use for horticulture purposes.

- **Reduction of Hard scape** – Several factors should be considered in selecting hard landscape.

- 1) **Fitness for content** – Material must contribute to feature of local distinctiveness.
- 2) **Fitness for purpose** – It should be designed for melting all requirements.
- 3) **Sustainability** – Material should be selected to minimize the need for maintenance in future.
- 4) **Work quality** – it must be of high standard.
- 5) **Environmental effects** – Production sources materials must have less impact on the environment.

Solar Energy Utilization –

- **Installation of Solar Photovoltaic panels** – It is a technique which generates electricity by solar panels mounted on the roof top of residential or commercial buildings. The various components including photovoltaic modules mounting, system, cables, solar inverters and other electrical accessories.

- Installation of Solar Assisted Water Heating system in buildings – This technique can be applied in hospitals and running home, hotels, lodges guest house or group housing with a plot area of 4000 sq.-m.

Energy Efficiency –

- **Energy Efficiency in heating, ventilation and air conditioning (HVAC) system** – It is an important feature of any building. It is used to maintain the environmental condition within the buildings or rooms regardless of the outside weather or environment. But in green buildings, the HAVC system used should be energy efficient because it required less energy and ultimately less energy leads to less power consumption and

less money. Now a question arises in mind how HAVC system works or what is the science behind the HAVC system. To measure the rating of energy-efficient HAVC system following scientific rating is used

1) Season Energy efficiency ratio (SEER) – It is measured in British thermal units (BTU). For this rating, higher the number of SEER more will energy-efficient HAVC system.

2) Energy efficient ratio – It is not much frequently used process. It is used in laboratory purposes.

Method of making HAVC unit energy efficient —

1) Use duct system of ventilation or air conditioning.

2) Increase insulation of your space.

3) Use aero seal duct sealing.

4) Make use of curtains and blinds

• **Lighting of common areas by solar energy/LED device** — Lighting is the process of utilizing light in the most efficient and effective way possible in order to achieve both aesthetic and remedial effects. Lighting is the best consolidate utilization of both counterfeit light source (like lights, LEDs, CFLs) and the normal light source that is day lighting. The principle well spring of day lighting are windows, bay windows or light.

The sun is an unlimited source of light and hot energy. The fundamental standard in the plans for involving sun based in structures is as per the following. The progression of nuclear power of the sun through conduction, convection, and radiation is utilized. These normal cycles are overseen through a structure plan that assists with heating up and cooling the structure.

The sunrays coming to the building surface are reflected, communicated, or consumed by the building materials. Furthermore, the hotness created by the sun causes unsurprising air development inside the planned regions. This fundamental impact of sun-based heat prompts the choice of materials and plan of building components that give a warming and cooling impact inside the structure like thickness (g/cm³), heat conduction coefficient, explicit hotness, surface assimilation, and reflection. It is feasible to use solar-powered energy as dynamic and latent through the action taken in the engineering plan.

Waste Management – Zero waste is a concept of waste management and planning approaches that stress through waste prevention, restructuring, production, and distribution system follow the 3R rule which is Reduce, Re-use, and Re-cycle the volume of waste to conserve and recover are used resources. This green waste can convert kitchen waste into manure construction and demolition waste into bricks, plastic waste, etc.

Segregation of Waste – The reason of using this technique in building to make the process simple for recycling of waste materials. That results a less waste get dump on land. As such making segregation part of waste management plan will deliver tangible financial result on business.

V. CONCLUSION

At last, we conclude that we can't have any structures which execute on zero carbon emission. But the green building is an amazing insertion that can reduce the impact on the environment by human behaviors. Recycle and reuse process is an indispensable part of green building. Given the political difficulties of obtaining energy and likely future shortage of conventional energy sources, we can't ignore the enormous conservation that green buildings make possible.

Collecting all the above we can say that green building is conducive to reducing energy contribution saving land resources and water use to meet the requirements of time and enhancing people's quality of life.

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