

Green Building Materials – A Way towards Sustainable Construction

Kulkarni sandeep
Pune (Maharashtra)

ABSTRACT

In India environmental problem are rising in construction industry due to leading urbanization. Increase in demand of houses which lead to consumes more energy, resources and raw materials which are responsible for the rise in carbon content in air and which are harmful to environment and human health. Now days we are facing various environmental impacts due to which we need to build with more sustainable materials which will help in reduction of impacts on environment. In metropolitan cities we are already noticing the change in weather patterns, hotter summers, shorter winters, insufficient monsoons. For the preservation of the ecology and finite energy resources of city is now very important. Building Industry needs to find better, more sustainable methods of designing their buildings in order to reduce their negative environmental impact. Therefore it is essential to use more sustainable materials and locally available materials which are eco-friendly which is essential for better future. Considering to all this impacts this paper consist a five green construction materials with their advantages, disadvantages, durability and economical aspects in construction industry which can be an effective alternate material for conventional materials..

Date of Submission: 10-07-2021

Date of Acceptance: 26-07-2021

I. INTRODUCTION

Buildings are actually responsible for maximum resource consumption therefore green building is only solution to the present trend of construction. A green building is one which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building.

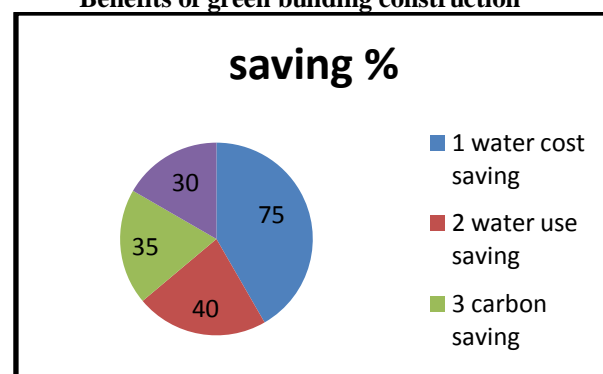
II. WHY GREEN?

Experts and scientists from the world around have implored citizens of the planet to make it their personal goal to improve the environment we live in. Fossil fuels are being depleted at an accelerating rate, the atmosphere is getting proliferated with dangerous toxins and the world is becoming a more difficult place to live in. The buildings consume a third of the world energy supply and they are responsible for 20% of the global pollution. If nothing changes, it could even double or triple by 2050.

The environmental benefits of green building include the protection of ecosystems and biodiversity, improved air and water quality, less waste flowing into streams, and the conservation of natural resources. Green buildings can also result in lower operating costs because they typically use less

energy and materials and improved indoor air quality, which improves the health of occupants.

Benefits of green building construction



III. BENEFITS OF GREEN MATERIALS

- Reduce Energy Consumption
- Reduce operating cost
- Sustained Savings
- Supporting Environment
- Improve Productivity
- Health and Safety Benefits

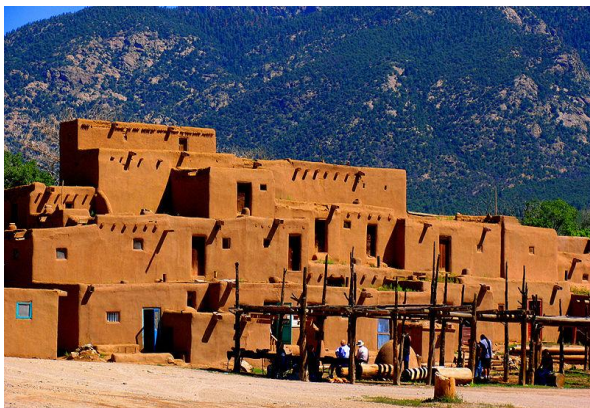
IV. GREEN BUILDING MATERIALS USED IN CONSTRUCTION

The aim of using green building materials is to construct energy-efficient structures and to build those structures one should be aware of different green building materials, their properties and how they contribute into saving energy. Following is the list of Green building materials used in construction:

- a) Earthen Materials
- b) Wood
- c) Bamboo
- d) SIPs
- e) Insulated Concrete Forms
- f) Cordwood
- g) Straw Bale
- h) Earth Bags
- i) Slate/ Stone Roofing
- j) Steel
- k) Thatch
- l) Composites
- m) Natural Fiber
- n) Polyurethane
- o) Fiber Glass
- p) Cellulose
- q) Cork
- r) Polystyrene and isocyanurate
- s) Natural Clay
- t) Non- VOC paints
- u) Natural Fiber Floor
- v) Fiber Cement
- w) Stone

a) Earthen Materials

- Earthen materials like adobe, cob, and rammed earth are being used for construction purposes since yore.
- For good strength and durability- chopped straw, grass and other fibrous materials etc. are added to earth.
- Even today, structures built with adobe or cob can be seen in some remote areas.



b) Engineered Wood

- Wood is one of the most famous building materials used around the world.
- But in the process of conversion of raw timber to wood boards and planks, most percentage of wood may get wasted.
- This wastage can also be used to make structural parts like walls, boards, doors etc. in the form of engineered wood.
- Unlike solid wood, engineered wood contains different layers of wood, usually the middle layers are made of wood scraps, softwoods, wood fibers etc.



c) Bamboo

- Bamboo is one of the most used multipurpose and durable materials used in construction.
- These trees grow faster irrespective of climatic conditions. So, it makes it economical as well.
- They can be used to construct frames or supports, walls, floors etc.
- They provide a good appearance to the structures.



d) Structural insulated panels

- Structural insulated panels (SIPs) consist of two sheets of oriented strand boards or flake board with a foam layer between them.

- They are generally available in larger sizes and are used as walls for the structure.
- Because of their large size, they need heavy equipment to install however, they provide good insulation.



e) Insulated Concrete Forms

- Insulated concrete forms contain two insulation layers with some space in between them. This space contains some arrangement for holding reinforcement bars, after placing reinforcement, concrete is poured into this space.
- They are light in weight, fire resistant, low dense and have good thermal and sound insulation properties.



f) Cordwood

- If wood is abundantly available and easily accessible to the site of construction, cordwood construction is recommended.
- It requires short and round pieces of wood which are laid one above the other, width wise, and are bonded together by special mortar mix.
- They are strong, environmental friendly and also give good appearance to the structure.



g) Straw Bale

- Straw bale is another green building material which can be used as framing material for building because of good insulating properties. They can also act as soundproof materials.
- Non-load bearing walls of straw bale can be used as fill material in between columns and, in beams framework is recommended.
- Since air cannot pass through them, straw bales also have some resistance to fire.



h) Earth Bags

- Earth bags or sand bags are also used to construct walls of a structure.
- These types of structures can be seen in military bases, near banks of water resources etc.
- Generally, bags made of burlap are recommended but they may rot very easily and hence, polypropylene bags are used nowadays.



i) Slate Roofing

- Slate is naturally formed rock which is used to make tiles.
- Slate tiles have high durability and they are used as roofing materials.
- Slate roofing is preferred when it is locally or cheaply available.



j) Steel

- Steel roof panels and shingles are highly durable and they can be recycled again and again. So, these are the best choices for green roofing materials.



k) Thatch

- Thatch is nothing but dry straw, dry water reed, dried rushes etc. These are the oldest roofing materials which are still in use in some remote locations of the world and even in cities for aesthetic attractions.
- It is cheaply available for roofing and a good insulator too.



l) Composites

- Roof panels made of composite materials such as foam or cellulose layer sandwiched between two metal sheets or two plastic sheets also come under green building materials.
- They are light in weight, inexpensive and provide good insulation for the structure and save energy.



m) Natural Fiber

- Natural fibers like cotton, wool can also be used as insulation materials.
- Recycled cotton fibers or wool fibers are converted into a batt and installed in preformed wooden frame sections.



n) Polyurethane

- Polyurethane foam is available in the form of spray bottles. They are directly sprayed onto the surface or wall or to which part insulation is required.
- After spraying it expands and forms a thick layer which hardens later on.
- They offer excellent insulation and prevent leakage of air.



o) Fiberglass

- Fiberglass is also used for insulation purposes in the form of fiberglass batts.
- Even though it contains some toxic binding agents, because of its super insulation property at low cost it can be considered as a green building material.



p) Cellulose

- Cellulose is a recycled product of paper waste and it is widely used around the world for insulation purposes in structure.
- It acts as good sound insulator and available for cheap prices in the market.



q) Cork

- Cork is also a good insulator. Boards or panels made of cork are available in markets.
- A great amount of electrical energy can be saved by corkboard insulation in winter.

- These cork boards are also good for sound insulation.



r) Polystyrene and isocyanurate

- Polystyrene and isocyanurate foam sheets are another type of insulation materials which are available in the form of boards or sheets.
- These are generally provided as insulators on exterior sides of a structure, below the grade etc.



s) Natural Clay

- Plastering of walls can be done using natural clay rather than other gypsum-based plasters.
- Natural clay plaster with proper workmanship gives a beautiful appearance to the interior.



t) Non-VOC paints



- Non-VOC paint or green paint is recommended over VOC containing paints.
- Presence of Volatile Organic Compounds (VOC) in paint reacts with sunlight and nitrogen oxide resulting in the formation of ozone which can cause severe health problems for the occupants.
- If non-VOC paint is not available then try the paint with very low-VOC content in it.

u) Natural Fiber Floor

- Naturally occurring materials like bamboo, wool and cotton fiber carpets, cork etc. can be used for flooring purposes.



v) Fiber Cement



- Fiber cement boards are made of cement, sand and wood fibers.
- For exterior siding, fiber cement boards are good choice because of their cheap price, good durability and good resistance against fire.

w) Stone



- Stone is a naturally occurring and a long-lasting building material. Some Stone structures built hundreds of years ago are still in existence without much abrasion.
- Stones are good against weathering hence they can be used to construct exterior walls, steps, exterior flooring etc.

V. CONCLUSION

This paper focused on the effort of using indigenous materials and resources in a way to make an energy-efficient green building having minimum impact on the environment by reducing the heavy dependency on the consumption of natural resources like wood, water etc. Using green materials are costlier than the conventional materials readily available, but they tend to save more on maintenance and running cost during its life time. The greenhouse designed is further low on maintenance as its construction involved extensive use of natural and eco-friendly materials. This work is a step towards making my part of the world green having minimum carbon footprint and to provide a healthy environment to its occupants by taking care of simple needs of providing good ventilation, natural lighting and healthy surroundings.

REFERENCES

- [1]. Azhar, S., Carlton, W. A., Olsen, D., & Ahmad, I. (2011). Building information modelling for sustainable design and LEED® rating analysis. *Automation in construction*, 20(2), 217-224.
- [2]. Howard, J. L. (2003). *The Federal Commitment to Green Building: Experiences and Expectations*. Federal Executive, Office Of The Federal Environmental Executive, Washington.
- [3]. Kats, G. (2003). *Green building costs and financial benefits* (p. 1). Boston, MA: Massachusetts Technology Collaborative.
- [4]. Efficiency, E. (2009). *Buildings energy data book*. US Department of Energy.

- <http://buildingsdatabook.eere.energy.gov/>. John Dieckmann is a director and Alissa Cooperman is a technologist in the Mechanical Systems Group of TIAX, Cambridge, Mass. James Brodrick, Ph. D., is a project manager with the Building Technologies Program, US Department of Energy, Washington, DC.
- [5]. Kibert, C. J. (2012). *Sustainable construction: green building design and delivery*. John Wiley & Sons.
- [6]. Mishra, S. P., Ali, S. M., Pradhan, A., Mohapatra, P., & Singh, V. (2013). Increasing energy efficiency in India by the use of green building. *International Journal of Renewable Energy Technology*, 4(4), 406-415.
- [7]. Floor, V., & Maaligai, E. S. Government of Tamil Nadu. [8] Sasikumar, N., & Jayasubramaniam, P. (2013). Solar energy system in India. *Journal of Business and Management*, 7(1), 61-68. [9] Smith, R. M. (2015). "Green" building in India: a comparative and spatial analysis of the LEED-India and GRIHA rating systems. *Asian*

Kulkarni sandeep. "Green Building Materials – A Way towards Sustainable Construction." *International Journal of Engineering Research and Applications (IJERA)*, vol.11 (7), 2021, pp 09-15.