JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DESIGN AND PLANNING OF GREEN BUILDING BASED ON ECOLOGICAL CONCEPT USING SKETCH UP AND TWIN MOTION

Paras Kharadi[1], Triparna Das[2], Ashish Nayan[3], Debapriya Das[4], Jaspreet Singh[5]
[1234]Undergraduate Students, School of Civil Engineering
Lovely Professional University, Phagwara, Punjab, India
[5]Assistant Professor, School of Civil Engineering
Lovely Professional University, Phagwara, Punjab, India

Abstract: The main goal of this report is to improve the sustainability of green buildings in the modern world. It is recommended to take appropriate steps towards improving the acceptance and momentum of sustainable practice. We have used twin motion and sketch up to show our design for sustainable construction. Twin motion was used in order to produce high quality images and videos, whereas on the other end sketch up was used for 3D Modelling. Passive and active energies are being used here in the form of direct and indirect sunlight like chromatic glass and solar panels and for waste we have used composites, zero VOC paints and cooling roofs to facilitate natural cooling and ventilation. We have also used rotating solar panels to capture maximum energy from the sun and because of its monochromatic properties, monochromatic glass reflects a great amount of UV light, which keeps the environment cool and helps to reduce global warming. Dual plumbing is becoming increasingly popular as it conserves water and helps to reduce water bills by reusing the grey water. Water harvesters are a necessity to conserve extra water and use it for future purposes.

***Index Terms* - Green building, Sustainability, Green construction**

I. INTRODUCTION

The architect and megacity journal Raymond Unwin may have been responsible for the term Green Belt in the 1920s. For him it was a direct buffer zone both between the marketable zones of municipalities as well as their domestic areas. “Greenbelt” is a common word which represents natural, uninhabited or agricultural lands which surround the built up areas. Therefore, greenbelt is a strategy & a property at which it uses an area selection for exercising a land use & planning to maintain these regions mainly raw, wild or tending land neighbouring the urban areas. Hence, the term greenbelt means planting of special type of greenery which is suitable to that particular climate zone & soil characteristics in that place which will make the area cooler, thus reduce air pollution, help soil erosion & further improved the soil fertility status. Greenbelt provides a barricade both between the plant and the girding areas. A truly large number of gassy and particulate air pollutants are emitted in the air terrain.

The physical and chemical parcels and the goods of those pollutants vary a great deal inclusively & synergistically. Hence, the development of green belts, by using pollution tolerant plants can contribute directly towards the air quality improvement. Therefore, it involves choosing of suitable plant species, determining their climatic as well as their parameters told by the soil, studying wind and temperature lives, nature of pollutants to be enhanced and the terrain of the position. The design for green belt can vary according to the points or the industries. It also improves the aesthetic value of the original terrain. Thus, the green belts are planned for open spaces shielded from experimental exertion like construction of structures, factories & any other infrastructural exertion, these areas are used only for growing the leafage covers. Green belts around the built up and the industrial areas are important for conserving the ecological health of the region.

Green structures are getting further and further alertness these days. A ‘Green’ structure is a structure which eliminates negative impacts in its design, construction or operation and hence reduces those impacts or can produce positive impacts, on our climate as well as natural terrain. It is also known as green construction or sustainable structure which refers to a structure as well as the operation of the processes that are environmentally responsible and resource effective throughout a structure's life- cycle. Green structures save precious natural resources and sustain our quality of life. Any structure can be a green structure, whether it’s a home, an office, a hospital, a community centre or any other type of structure.

The priority of environmentally friendly construction in government programs, analogous as the EU’s Green Deal, indicates that structures are likely to play a vital role in countries sweats to achieve a net-zero emissions. In practice, we have come a long way from putting some grasses on top of an office and calling it a green structure. Pretensions of the green structure are Life cycle assessment, Siting and structure design effectiveness, Energy effectiveness, Water effectiveness, Inner environmental quality enhancement, Operations and conservation optimization, Waste reduction, these are some aims for green structure. Therefore, the

common motive of green structures is to reduce the overall impact on the erected terrain, human health & as well as the natural ecosystem.

II. OBJECTIVE OF STUDY

- Sustainable and eco-friendly structures
- Design and planning of town or city Future visualisation
- New implementation and innovation in the design

III. METHODOLOGY

This report is aimed at study and development of green building structures and therefore, redesigning the green building for a sustainable cause which is both good for the environment as well as human life's. Also, it aimed to spread awareness among the people over the world about the advantages of using green building materials and sustainable materials.

Green building and its construction has been done in previous also but the main aim for this research is that how can we enhance those researches and practically implement those and hence can contribute to the sustainable and environment friendly design. Therefore, the study has been done by using Google, YouTube, Sketch Up and Twin motion application which were used for the model implications and designing.

Sketch up, it's an 3d application used for drawing and designing thus its used for all types of designing including interior, civil or mechanical. The layout and modelling of the house has been done in sketch up. It can be used to produce standard or 360° VR videos from imported Sketch up or CAD models.

Whereas twin motion, it's an real time visualizing software which empowers us to produce high quality pictures and videos which is basically design for architectural ,landscape and urban planning designs. It has asset library with, light sources, realistic objects and 3d objects like car, tree, landscape, etc. which can directly be implicated on the project.

IV. DISCUSSION

A. ROTATING SOLAR PANELS

The panels rotate along with the direction of sun so that it can capture maximum amount of light rays. By this technology of rotation its efficiency is increased up to 32% where as normal solar panels are giving only 29%. It may be costly at first but it doesn't have any further expenses in future thus provide us a sustainable environment to us.

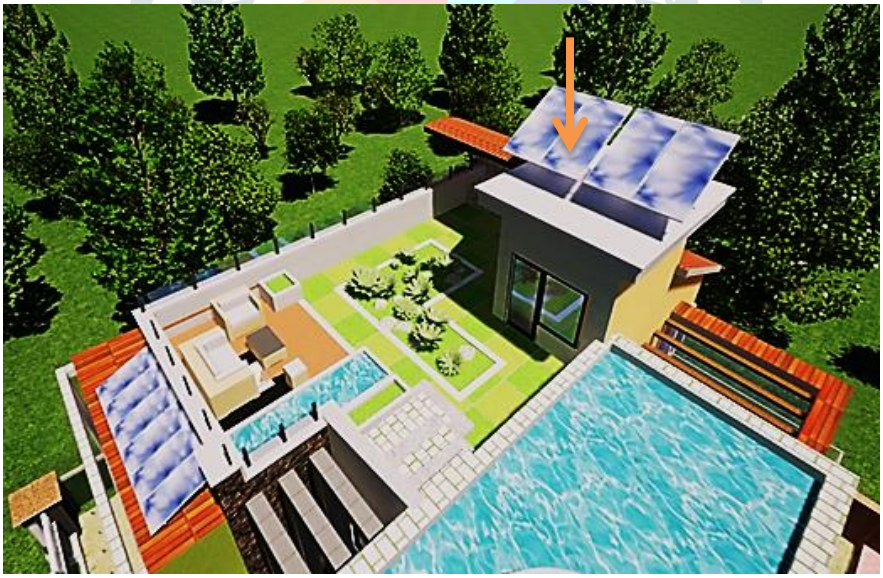

Figure Number 1: (Rotating solar panel)

B. RAIN WATER HARVESTING

Collecting the rain water from roof or any higher surfaces and storing it underground areas or any other suitable places near your house through the pipes. Hence, it decreases the water needs as well as it doesn't need high maintenance costs. It has many advantages as it's easy to maintain as well as its installation as compared to other water purifier is cheap. It also reduces water bills as water in the harvester can be used for various non-drinkable purposes. Uses include watering of gardens, livestock, irrigation, domestic use with proper treatment, and domestic heating. The harvested water can also be committed to longer-term storages.

Figure Number 2: (Water harvester)

C. ELECTROCHROMIC SMART GLASSES

Electronic smart glasses are very smart work solution for the buildings as it mainly works in summer season, it can exclude the heat radiations. Therefore, these smart glasses use slightly electric signals to that they can slightly charge the windows to vary the number of reflection. One of the examples of such glasses is sage glass, it helps to maximize the solar energy and therefore minimizing the heat and glare. It contributes in sustainable development by conserving the energies up to 20% of the overall cost of the building.

Figure Number 3: (Smart windows)

D. COOL ROOF

It is used to reflect more sunlight than a standard roof, hence it absorbs less energy. Apparently it cost is same as normal roof so it is quite affordable. It also saves energy by reducing the use of air conditioners in the house which is environment friendly, decreases the temperature of the roof can directly increase the roof serviceability. It also helps in preventing the global warming by reducing reflecting more sunlight also reduces heat island effects. Tiles are one of the marvellous, but overlooked, cool roofing material. As they are popular in warm and sunny climates. Usually, they are made from ceramic, but can be made from cement as well. Clay is more reflective than cement, but tile's reflecting property depends heavily on their colour. Therefore, white clay tile can reflect up to 70% whereas red clay can only reflect up to 20%.

Figure Number 4: (Cool roofs)

E. ACTIVE SOLAR PANEL

Solar energies are captured and store for future use, as it converts solar energy into electrical energy. It is costly but gives high revenue in energy conservation as it directly converts radiation into electricity. Therefore, it saves environment in both ways by absorbing the radiation and reducing global warming as well as converting radiation to save energy also. Hence it saves fuel bills in winter and also contributes to the less pollution scheme as it reduces air pollution as well as reduces green gases thus by reducing the plant and fossil fuel consumption which is usually used for heating in winters and generating electricity.

Figure Number 5: (Active solar panels)

F. ZERO-VOC PAINT

The paint contains no volatile organic compounds nor does it emit any harmful impact to humans as well as it is environment friendly. Mainly used in indoor and outdoor. It has very less odour, dries very fast also has very good coverage. Can be applied to different surfaces and hence it can be found in different shades and variety of colours. Normal paints are quite harmful whereas Zero-VOC paint improved the air quality of the surrounding even it also reduces labour cost with a good coating of walls. Hence, it reduces the rust zone penetration at the edges and has better rust edge retention after drying.

Figure Number 6: (Zero VOC paint)

G. GREEN BUILDING CELLULOSE

It's an insulation material which is made from recycled newspapers which helps in reducing noise as well as heat. Use in wall and roof constructions. This insulation is provided from inside the house which helps to maintain the room temperature and has 85% recycled content. Using this green building material it reduces a greater amount of energy required which is used to heat a building while lowering the carbon footprint of any expansions, renovation or any constructing projects. Hence it's impossible for bugs and other insects or any other small mammals to thrive through the building walls.

Figure Number 7: (Building cellulose)

H. COMPOSITE WASTE

Breaking down all organic household waste with the help of micro-organism present in earth. It first helps recycling the waste from the house and also helps in converting waste into manure which is very good for the plant growth. It doesn't need any other chemical just need micro-organisms like earthworm and other ground related worms to convert it with the help of the soil mineral and small amount of light. It has no harm to humans thus very good for the environment as it is eco-friendly and biodegradable. Comes under renewable resources and simple to manage. Therefore, it's not toxic and reduces carbon emissions.

Figure Number 8: (Composite waste)

I. PASSIVE SOLAR ENERGY

It directly takes light and heat from the sunlight. As it capture sunlight within the building's materials and then release that heat during periods when the sun is absent, such as at night, therefore houses can be put on comfort zone for 24/7 even in the spaces that would normally get cool. Therefore, it saves up to 25% of energy consumption as well as the solar panels which will be installed will reduce panel consumption up to 25%. It's a very good source for the renewable sources. Thus it is environment friendly and saves a lot of money too.

Figure Number 9: (Passive solar energy)

J. DUAL PLUMBING TECHNOLOGIES

Dual plumbing system is a technique in which two completely different or separate water pipe lines are used to deliver water to the house. We can re-use all the house hold grey water in the house like water from bathing, kitchen or any other places. Grey water produced from houses can be used for irrigation and flushing of toilets or do laundries or etc. work could be done by using this grey water. Therefore, this water is safe for landscape uses. It is easy to use and helps to reduce water consumption.

K. FIBRE CEMENT

Fibre cement is used for cladding and roof material. It has great strengths durability that's why it is mainly used in roofing. Also it has fire proof property and it need low maintenance, can tolerate any climate as it resist all the weather conditions. Therefore, it absorbs moisture from rain, snow, heat and humidity. Hence it's ideal for Tornado and Hurricane Prone Areas because of its strength and moisture absorbing capacity it is highly suitable for these areas. And thus it is sustainable and a very good choice for construction as it has high durability.

Figure Number 10: (Fibre Cement)

L. LOW EMITTING MATERIAL

LEM are those materials which don't release any significant pollutants into the indoor environment. Hence the materials could be interior paint, coating flooring, composite woods, furniture, ceiling, thermal insulation and etc. Therefore, it reduces the symptoms of sick building syndrome that includes headaches, fatigue, etc. Also reduces water pollution and ensure the water safety along with health while they are working.

Figure Number 11: (Low emitting material)

V. CONCLUSION

From the above-mentioned research papers, we can conclude that green building is conducive to reduce energy consumption; as it saves land resources as well as water consumptions, therefore reduce the soil erosion, water pollution and air pollution, hence enhance people's living quality. In the future the construction industry, of the green building will become the main cultural and sustainable concept so that it can attract a lot people to buy it. Hence, with the globalization and technological progress, the world's environmental issues has become one of the biggest barrier to people's lives, as people living environment is getting worse. It's then when people started to notice the environmental issues and thus came forward with the idea of green building.

Therefore, Green building is a latest architectural concept, as well as the future of modern construction industry. It will be the sunrise technology concept for construction industry in recent years. Green building concept in the construction industry has become a new era, as it can reduce the waste of resources, also can improve the resource utilization, but also can reduce human activities on the destruction of nature; as a result it will improve people's living quality and thus will promote harmony between human and nature.

The use of environmental friendly energy-saving technologies like solar panels and monochromatic windows are contribution to a sustainable and environment friendly structures, enabling green energy saves technologies to boost their effectiveness in construction. By using these green buildings concepts can help the world as well as India in satisfying the shortage of valuable resources and also can prevent environmental degradation.

If trees are cut off for constructing the buildings then same number of trees should be planted somewhere else. Only this mentality of humans can save the planet from demolition. Therefore, advancing the structure by maintaining environmental condition and hence contributing to the sustainable development.

As green building saves a lot money if think wisely, meanwhile introducing passive and active solar sources are worthwhile decision even adding of composite and harvester , which are very easy to manage is new way to support environment. Cool roof technology is one of best option for roofing as it cost same as normal roof but it gives much more cooler environment then other roofing even addition of insulating material into the walls is good for the environment.

Therefore, electro chromic glasses are one of the best's solutions for the environment as it reduces global warming by reflecting the maximum amount of sunlight and hence keep the surrounding and the house much cooler than normal window houses. Green building cellulose is an insulating material which has 85% recycled item in it like newspaper and supports environment. Whereas, Fibre cement, zero VOC paints, dual plumbing all these supports the environment and thus also contribute in a development of constructing areas for future.

VI. ACKNOWLEDGMENT

We would like to express our sincere thanks to our project coordinator, Mr. Jaspreet Singh, for giving us the opportunity to work on the project and also for helping us to complete it. All in all we would like to thank everyone involved in this project and helped us with their suggestions to make the project better.

VII. References

1. Subramaniyam, P., Srinivasan, K., & Prabaharan, M. (2011). Approach for green product design. International Journal of Innovation, Management and Technology, 2(3), 244.
2. Abbasi, T., Tauseef, S. M., Khan, F. I., & Abbasi, S. A. (2012). Mathematical Modeling for the Design of Greenbelts for Air Pollution Control: An Engineering Perspective. Bonfring International Journal of Industrial Engineering and Management Science, 2(1), 30-34.
3. Amati, M., & Taylor, L. (2010). From green belts to green infrastructure. Planning Practice & Research, 25(2), 143-155.

4. Han, H., Huang, C., Ahn, K. H., Shu, X., Lin, L., & Qiu, D. (2017). The effects of greenbelt policies on land development: Evidence from the deregulation of the greenbelt in the Seoul metropolitan area. Sustainability, 9(7), 1259.
5. Umar, U. A., Tukur, H., Khamidi, M., & Alkali, A. U. (2013). Impact of environmental assessment of green building materials on sustainable rating system. In Advanced Materials Research (Vol. 689, pp. 398-402). Trans Tech Publications Ltd.
6. Abbasi, S., Chari, A., Gajalakshmi, K. B., Ramesh, R. E., & Ramasamy, E. V. (2004). Approaches to greenbelt design. J Inst Public Health Engi, 3, 42-49.
7. Mane, M. P. D. Green Buildings and Sustainable Construction.
8. Islam, S., Al Awadh, M. A., & Khan, R. A. (2015). Recent trends in the green building concept. Int. J. Adv. Innovative Res, 5(1).
9. Khoshnava, S. M., Rostami, R., Mohamad Zin, R., Štreimikienė, D., Mardani, A., & Ismail, M. (2020). The Role of Green Building Materials in Reducing Environmental and Human Health Impacts. International journal of environmental research and public health, 17(7), 2589.
10. Assylbekov, D., Nadeem, A., Hossain, M. A., Akhanova, G., & Khalfan, M. (2021). Factors Influencing Green Building Development in Kazakhstan. Buildings, 11(12), 634.
11. Zhang, P. Q., & Wang, Y. (2016). Research on green building design based on ecological concept. In MATEC Web of Conferences (Vol. 63, p. 02040). EDP Sciences.
12. Kotkar, A., & Salunkhe, H. (2017). A review paper on green building research. Inter. J. of Adv. Res. in Sci. and Eng., 6, 901-906.
13. Li, Y., Rong, Y., Ahmad, U. M., Wang, X., Zuo, J., & Mao, G. (2021). A comprehensive review on green buildings research: bibliometric analysis during 1998–2018. Environmental Science and Pollution Research, 1-19.
14. Sun, L., Fertner, C., & Jørgensen, G. (2021). Beijing's First Green Belt—A 50-year long Chinese planning story. Land, 10(9), 969.
15. Akimowicz, M., Cummings, H., & Landman, K. (2016). Green lights in the Greenbelt? A qualitative analysis of farm investment decision-making in peri-urban Southern Ontario. Land use policy, 55, 24-36.
16. Ramesh, R. M., & Nijagunappa, R. (2014). Development of urban green belts-a super future for ecological balance, Gulbarga city, Karnataka. International Letters of Natural Sciences, 22.
17. Zhou, L., Gilbert, S., Wang, Y., Cabré, M. M., & Gallagher, K. P. (2018). Moving the green belt and road initiative: from words to actions.
18. Manna, D., & Banerjee, S. (2019). A review on green building movement in India. Int J Sci Technol Res, 8(10), 1980-1986.
19. Gogoi, D. B. J., & Giri, D. T. K. (2017). Green Building Requirement in India and Factors Driving Green Building Purchase. International Journal of Civil Engineering and Technology, 8(10).
20. Huang, A., Xu, Y., Liu, C., Lu, L., Zhang, Y., Sun, P., ... & Xiang, Y. (2019). Simulated town expansion under ecological constraints: A case study of Zhangbei County, Heibei Province, China. Habitat International, 91, 101986.
21. Xie, X., Kang, H., Behnisch, M., Baildon, M., & Krüger, T. (2020). To what extent can the green belts prevent urban sprawl?—a comparative study of Frankfurt am Main, London and Seoul. Sustainability, 12(2), 679.
22. Mohseni Moghadam, M. (2017). Green Belt, a Local Approach For Environmental Challenges. MANZAR, the Scientific Journal of landscape, 8(37), 56-65.
23. Kumar, V. V., Swathy, S., Radhika, R., Khan, M. F., & Chakradhar, B. (2019). Green Belt Requirement for New and Expansion Projects for Obtaining Environmental Clearance in India. International Journal of Applied Environmental Sciences, 14(5), 475-487
24. Akadiri, P.O., Chinyio, E.A., and P.O. Olomolaiye. 2012. Design of A Sustainable Building: A Conceptual Framework for Implementing Sustainability in the Building Sector. Buildings 2: 126-152.
25. Kong, L. (2012). Break the green belt? The differences between green belt and its alternative green wedge: A comparative study of London and Stockholm.
26. Asim, F., & Shree, V. (2018). A Century of Futurist Architecture: From Theory to Reality.
27. Gautier, G., Piddington, C., Bassanino, M. N., Fernando, T., & Skjærbæk, J. (2008). Futuristic design review in the construction industry.
28. Parashar, A., & Parashar, R. (2012). Construction of an eco-friendly building using green building approach. Inter. J. of Sci. and Eng. Res., 3, 1-7.
29. Wang, Y., & Li, Y. (2021). Study on the Influence Path of Sustainable Development of Green Building in Tianjin. In E3S Web of Conferences (Vol. 248, p. 02022). EDP Sciences.
30. Nayak, P., & Kayarkatte, N. (2020). Sustainability Study of Green Buildings in India-Through Pestle and Swoc Analysis. International journal of business management and allied science.