Preliminary Application of Green Building Principles to a Library

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ABSTRACT

Green buildings are one of the creations of modern architectures that are popularly used in latest technologies. They are designed, constructed, and operated in such a way that they have minimal environmental impact and attempts to leave a positive impact on the same throughout the entire building life-cycle. Due to the rapid growth of technology, there is diminishing of the resources or pollution of the environment. Therefore, we desperately need to save the environment which is the resource of life on earth. In architecture, green and sustainable building construction is sought-after. IGBC (Indian Green Building Council) is the Indian standard to measure the performance, whereas LEED (Leadership in Energy and Environmental Design) is the major performance standard in countries abroad. This paper deals with the concept of green building used in the construction of a library. This involves the plan, methodologies incorporated, various components encompassed, how they are authorized and about how energy efficient the library is. In order to achieve energy efficiency, numerous renewable resources are used in the place of non-renewable resources. It is also made sure that a number of factors are considered before deciding the selection of materials and components for green library construction. This critical review also explores various advantages and limitations associated with green components and recommend strategies to overcome. The outlook of the research spans the political, economic, technological, social, and environmental perspectives. This study reveals the significance and challenges of sustainable library for special collections, and takes them a step further by favoring a user-centered design approach that encompasses more user-importance levels than energy and resource points. Such an approach can provide increased insights into sustainable design, planning and administration, resulting in a greater likelihood of meeting users needs, demands and expectations.

Keyword: - *Green Library, Green Building Concept, Filler roof, Wind Turbine Ventilator, Pavegen Flooring*.

1. FIELD STUDIES

The site selected for this project is Surya City 2nd Phase, Anekal. The coordinates of the site are 12°46’48.6’’N 77°41’09.3’’E. The total site area is 2.7 Acre which is north facing towards the road. The site is located in an area which has less traffic and which is an added benefit for the library as it is calm and silent. The area is surrounded by trees all around it. The total built up area of the library is 7400 sq.m.

2. GREEN BUILDING COMPONENTS

2.1 Plan

2.2 Filler Roof

The concept of filler roof being sustainable both economically and environmentally, also its other benefits are mentioned in [1] [4]. Filler slab is the upper portion of a roof that is supported by compressive forces while the lower portion is subjected to tensile forces, for reinforcement steel is replaced by Bamboo and a Filler material is placed between the ribs and concrete is poured into the gaps to make a filler slab. This eliminates the need for concrete in the bottom portion of the slab.

In this mechanism, Bamboo is used as a direct replacement of steel for reinforcement, bamboo is also called as the 'Green Steel' due to its good tensile strength which is the main requirement of a reinforcement material. In conventional steel-reinforced concrete design, members are designed to be 'under reinforced' such that the reinforcing steel yields prior to concrete crushing, but for a brittle reinforcing material such as bamboo failure is unacceptable and thus an 'over-reinforced' design is prescribed by which limited ductility is achieved through concrete crushing. For concrete, blast furnace slag is used which is a by-product that can be recycled and used to make an environmentally friendly alternative to concrete. This glassy granular material is produced by quenching molten iron slag from the blast furnace into water or steam. This material can replace about 70% to 80% cement, and improves the durability of the concrete. Between the reinforcement ribs filler material is placed like Mangalore Tiles, Earthen Pots, Stabilized Mud Blocks, bricks etc., and concrete is poured to fill the gaps hence concrete in the bottom region of the slab is replaced by an energy efficient and cost-effective material.

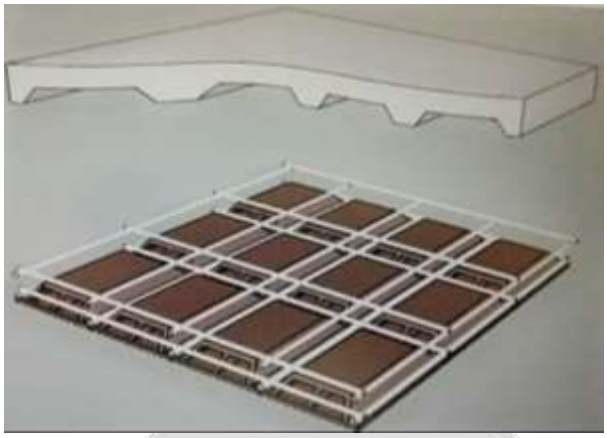

Fig -1: Filler Roof

2.3 Wind Turbine Ventilators

Bachhav Rakesh B et. al [3] have proposed a review on wind ventilator through Electricity Generated System Wind turbine ventilators are installed on the roof of a structure in order to regulate the heat level of a building by removing hot air. As the name suggests, these ventilators operated only on the power of the wind current experienced by the turbine inside the ventilator mounted on top of the roof. These turbine ventilators are rounded structures which contains fan with a low self-weight attached inside. Due to the low self-weight of the fins, even just a little bit of wind can be just enough for the turbo ventilator to rotate. The faster the wind currents experienced by the fans, the faster the turbine will rotate and exhaust the heat, smoke, fumes, humidity, etc. A well-designed turbine ventilator takes advantage of the wind to create a positive flow through the throat of the ventilator. The ventilators are regulated by a thermostat which can control the fan hence regulating the inside temperature. The wiring of the fan may be done in several ways. The fan is usually directly hardwired into the circuit which is intern controlled by a thermostat which ranges from 16°c to 49°c. This can also be controlled with a switch. The wind influences the turbine to operate in the two major ways which are listed below.

1.Because of the Wind approaching the turbine and striking the ventilator, it jumps, making a section of low pressure on the leeward of the rotating apparatus This low-pressure zone is fed by drawing air from the rotating fan, inflects endless extraction of air from the building.

2. As the rotating turbine rotates, the centripetal forces related to the rotation fling air outward kind the tips of the vanes. Replacement air is drawn into the throat of the ventilator from the building inflicting continuous ventilation the turbine can even rotate and exhaust within the absence of wind with the help of the thermal currents developed inside the building.

Comparison of Wind Ventilators with Electric Powered Ventilators.

Electric Powered Ventilators	**Wind Turbine Ventilators**
Runs on electric power hence high running power cost	Runs on free wind power hence zero running power cost
Can be installed only where electric power is available	Can be installed anywhere as it runs on wind power
Wall installation prevents uniform ventilation	Rooftop installation ensures uniform ventilation

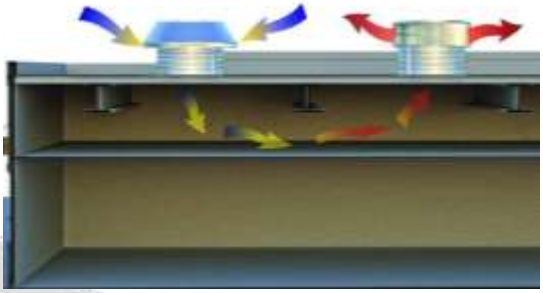

Fig -2: Wind Turbine Ventilators

2.4 Pavegen Flooring

Shreedhar Patel et. al [2] have proposed the concept of Energy Generation and Implementation of Power Floor, Pavegen Flooring is made out of triangular units of individual piezoelectric tiles which generates a constant flow of electricity when it is threaded on. Power is generated when the tile is compressed by a single step. These tiles work on the principle of piezoelectric effect which is the ability of a material to generate electricity when it's compressed as well as induction, through numerous tiny copper coils and magnets, to create a charge. Each compression i.e. each step takes on these tiles can generate up to 6 to 8 watt of electricity. It is composed of several materials. The top surface of the flooring tile unit is made from recycled rubber and stainless steel. The base of the slab is constructed from over 80% recycled rubber with concrete. The size of each individual tile is 600*450*87(L*B*H) mm.

Pavegen has found how convert a gradual step into a steady electrical current because of a design that uses piezo effect with a regulator that uses electromagnetic induction and inertia to maximize the electricity generation. Its design plays a major role in its efficiency, the triangular form permits identical quantity of mechanical energy to be transferred in spite of wherever a person steps the tile.

Once an object is subjected to mechanical pressure (i.e., somebody steps on it) it creates an electrical current. The electricity is usually found in crystalline materials that have asymmetric unit cells. Due to this asymmetry, once a mechanical force deforms an electricity material, the (polarized) unit cells shift into a different pattern - one that's typically a lot more aligned and regular. As a result, dipole effects build up, and a potential difference is generated across the crystal, dielectric permittivity and electric field.

Fig -2: Pavegen Flooring

3. DISSCUSION

In this section, we have put forth the some of the reasons why the physical components and the energy efficiency elements are implemented for the green building project. These components are not only economically and environmentally sustainable but also leave behind a little or no carbon footprint during their operation and manufacturing.

Wind Turbine Ventilators

- The main purpose of attic ventilator is that it doesn't let humidity and hot air build up inside the build up inside the building. This not only avoids molding and rotting of some of the wood components inside the building but it also keeps the building cool.
- These ventilators require no energy to operate as the turbine inside spins due to the air current on top of the building making it economical and eco-friendly. They rarely breakdown because of their simple rounded design which are rarely disturbed by any large debris making it ideal for the long run.

Pavegen flooring

- These tiles are built to tolerate rough environment and are manufactured in a completely eco sustainable way as their surface made from recycled rubber. They are damp-proof and water proof and can be installed indoors or outdoors in high traffic area conditions.
- These tiles are completely renewable and ecofriendly technology. They reduce approximately 6.817 tons of excessive CO2 emission every day if implemented in a large scale.

Bamboo frames

- Bamboo is an environment friendly construction material and does not cause pollution. Bamboo is more durable as compared to other construction materials. Its naturally waxy surface does not require painting; making it safe from health
- The low self-weight of bamboo makes very easy to transport and install. The process of assembling and cutting can be done on site making it cost effective.

Terracotta Jaalis with Transparent Wood

- One of the main advantages of transparent wood glass typical glass is its applications of ductility, and resistance to fracture which is higher compared to glass.
- It's almost transparent as glass but it's much higher strength than glass, better biodegradable material. Wood is employed to make super strong and energy efficient windows.

Filler Roof

- Although cement is very hard to substitute its total volume can be decreased using Filler Roof. This not only makes it economical but also eco-friendly. The Load bearing capacity is no less in performance from the conventional RCC slab.
- Filler Roof consumes less concrete and replacement of steel with bamboo reduces the considerably reduces Carbon footprints by 70% compared to regular RCC Slab.

Skylight

- One of the most positive aspects of having a skylight is that it brings extra daylight into the building. Due to increase in natural light from skylights, the use of artificial lighting and electricity can be reduced. The natural sunlight that a skylight provides is good for health. It is known to reduce Stress and anxiety.

Solar panels

- The most enticing part about investing in solar panels is the fact that the use of solar energy doesn't cause any pollution at all and it is also a form of renewable energy.

Root Zone Waste Water Treatment

- It achieves standards for tertiary treatment with low cost, such as no electricity, no chemicals for PH adjustment. Low maintenance cost, since it involves no machinery and its maintenance, and no sludge handling problem.

Solar street lights

- The main advantages of solar powered lights are that they are reliable since they depend less on conventional energy and the national grid. They do not consume much electricity and do not require maintenance or repair from time to time. Operational costs are almost nil. These lights are also durable, weather- proof and water-proof.

4. CONCLUSION

From the case studies and literatures reviewed green buildings provide better health for building occupants due to improved indoor quality, energy efficient components. The ecological and emissions costs are lower, uses fewer natural resources so as to protect the ecosystem, reduces strain on local resources, low maintenance and operational cost, water and material efficient. This study will bring more alertness to the public about the benefits of Green Buildings and why we need green buildings which are cost-effective and makes financial sense today.

5. REFERENCES

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