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GREEN TECHNOLOGYAND ITS APPLICATIONS

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ABSTRACT - *A green building, which is also known as a sustainable building is designed to meet some objectives such as occupant health; using energy, water, and other resources more efficiently; and reducing the overall impact to the environment. It is an opportunity to use the resources efficiently while creating healthier buildings that improve human health, build a better environment, and provide cost savings. All the development projects lead to over-consumption of natural resources. This leads to serious environmental problems.*

Green building concept deals with the optimum use of natural resources for the ***development of infrastructure****. The low cost eco-friendly house is the modern construction method which uses locally available material and unskilled labor and also* ***reduces the construction time****. Similarly, use of recycled plastic, recycled aggregates and municipal wastes for the construction of pavement has considerable effect on the environment of earth.*

1. INTRODUCTION:

Green building is defined by the Office of the Federal Environmental Executive as "the practice of:

1) Increasing the efficiency with which buildings and their sites use energy, water, and materials, and
2) Reducing building impacts of human health and the environment, through better siting, design, construction, operation, maintenance, and removal throughout the complete life cycle."1 While the green building movement has gained momentum in the last decade, the origin can be traced back to the late nineteenth century.

According to David Giessen, curator of architecture and design and the National Building Museum in Washington DC, structures such as London's Crystal Palace and Milan's Galleria Vitoria Emmanuelle II used methods that decreased the impact of the structure on the environment. Systems such as roof ventilators and underground air-cooling chambers were used to regulate indoor air temperature. In the early twentieth century, several skyscrapers such as the Flatiron Building and the New York Times Building in New York utilized deep-set windows and the Carson Pirie Scott department store in Chicago had retractable awnings. Both of these techniques were effective in controlling interior temperature while lessoning the buildings‟ impact on the environment.

From the 1930‟s through the 1960‟s, the forward thinking cooling methods mentioned above gave way to some new building technologies that would change inner-city building construction dramatically. The invention of air conditioning, reflective glass, and structural steel popularized the enclosed glass and steel buildings that litter the American city today.

2. History of Green Building:

Around the time that the "glass box" style high rise had become the icon of the American city (circa 1970), a forward thinking group of architects, environmentalists, and ecologists5 were inspired by the growing environmental movement and the higher fuel costs that were prevalent during the 1970s.6 The genesis of these two scenarios ultimately resulted in the modern build green movement.

The first Earth Day, celebrated in April 1970, gave some credence to this new building concept, but the OPEC oil embargo of 1973 gave the burgeoning environmental movement, and subsequently the green build effort, the kick start it needed.

3. Where are we now?

With the overwhelming success of the "Greening of the White House" other governmental institutions have since been given a green makeover. The Pentagon, the Presidio, and the U.S. Department of Energy, among others have gone green.

The concepts of building green and, on a larger scale, sustainability are ideas that we hear all of the time. These

two concepts, however, are rarely properly understood. "Sustainability is a systemic concept, relating to the continuity of economic, social, institutional and environmental aspects of human society, as well as the non-human environment. It is intended to be a means of configuring civilization and human activity so that society, its members and its economies are able to meet their needs and express their greatest potential in the present, while preserving biodiversity and natural ecosystems, and planning and acting for the ability to maintain these ideals for a very long time. Sustainability affects every level of organization, from the local neighborhood to the entire planet".17 In short, the concept of sustainability refers to thinking holistically about how everything you do affects everything around you. It is an attempt to minimize each person's impact on the world.

Today, green building is one of the fastest growing building and design concepts. Every month new magazines are popping up that report on this growing trend. Architects, designers, and homeowners are becoming infatuated with the cost saving possibilities, energy saving emphasis, modern look, and the symbiotic relationship with nature that green buildings possess.

The United States Green Build Council (USGBC) is the foremost leader and educator within the world of green building today. They are the sanctioning body for LEED, the program with which points are awarded to various design applications within a building ultimately resulting in LEED certification for the building.

4. USGBC (The United States Green Build Council) & LEED (Leadership in Energy and Environmental Design):

The USGBC was created to promote the design and construction of buildings that are environmentally responsible, profitable, and healthy places to live and work. They are focused on integrating building industry sectors and leading a market transformation towards greener construction. The organization consists of various trade associations, architects, designers, and individuals all interested in the greening of the construction business.18 Between 1990 and 1995, the USGBC worked feverishly with the American Society of Testing and Materials in order to create a rating system for sustainability. ASTM's rigorous consensus-based process moved much too slowly for the USGBC and in 1995it was determined that they would create their own rating system to exist under the USGBC banner. A committee was formed to study other green building programs currently in existence and after three years LEED 1.0 unveiled. By 2003, LEED was refined down to its current form that is the talk of the construction and design communities.

5. LEED:

In short, LEED is a system for designing, constructing, and certifying green buildings. Buildings are classified as Certified, Silver, Gold, or Platinum depending upon the number of points they acquire within 6 building components:

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Design Process

Within each of these categories, there are a specific number of credits available via many subcategories. LEED ratings are rapidly becoming boasting points for property owners with property values of LEED certified buildings skyrocketing.

LEED has been assisted in its success by the early adoption of many government agencies. Today, however, it is mostly a market driven engine with the number of LEED registered projects growing each year.

6. Material and Product Selection:

- Use building materials and products that contain post-consumer recycled content.
- Support the regional economy by using materials and products manufactured regionally.
- Encourage environmentally responsible forestry through the use of wood or wood-based material that meets Forest Stewardship Council's Principles and Criteria for wood building components.
- Utilize rapidly renewable materials, such as bamboo flooring, wool carpets, strawboard, cotton ball insulation (made from denim scrap), genuine linoleum flooring, or poplar oriented-strand board (OSB). Using rapid renewables helps reduce the use and depletion of finite raw materials.

7. Construction and Demolition Waste Management:

- Develop and implement a waste management plan that diverts a substantial amount of construction,

demolition, and land-clearing debris from landfills to recycling or salvage facilities.
- Reuse a percentage of salvage or refurbished materials from construction, demolition, or land clearing as new building material.

8. Energy and Atmosphere:

- Generate building electricity on site, from renewable resources like geothermal, solar, or biogas sources.
- Eliminate the use of CFCs (chlorofluorocarbons) in new heating, ventilation, air-conditioning, and refrigeration (HVAC & R) systems. Eliminating the use of CFCs reduces ozone depletion.
- Contract with a green power provider to purchase building electricity generated from renewable resources, such as solar, wind, geothermal, biomass, or low- impact hydro sources.
- Optimize energy performance.

9. Water Management:

- Install water-efficient or low-flow equipment and appliances in kitchens and bathrooms to reduce water consumption.
- Use water-efficient irrigation, captured rain, or site-recycled water for onsite landscaping.
- Utilize innovative wastewater technologies, such as treating waste water on site or significantly decreasing the amount of potable water used for sewage conveyance.

10. Indoor Environment:

- Design the HVAC system and building envelope to provide for the most optimal delivery and mixing of fresh air.
- Reduce the number of indoor air contaminants by selecting paints and coatings, adhesives, carpets, and composite woods that emit low VOCs (volatile organic compounds) or none at all.
- Establish segregated areas for chemical- using operations (such as copy/printing rooms and housekeeping); these areas should have separated outside exhaust and no air recirculation.
- Maximize day lighting and view opportunities. Day lighting and increasedview opportunities can save energy costs and enhance worker productivity.

11. Sustainable Design and the Green Building Movement:

Sustainable design, as known as environmental design or green building, can be defined as the philosophy of designing physical objects, the built environment, and services that comply with the principles of economic, social, and ecological sustainability (McLennan 2004). Education on sustainability and green building has made an even larger impact in the design world since organizations have begun to fully embrace the idea and positively encourage leaders, developers, designers and students to learn and practice these techniques (American Institute of Architects (AIA) 2014, American Society of Landscape Architects (ASLA), 2014, U.S. Green Building Council 2014). The American Society of Landscape Architects for example, has devoted their annual Professional and Student Award competitions to sustainable landscape design ideas that are new and up-and-coming in developing hypothetical design, as well as in existing designs (ASLA2014). Major cities such as Chicago, are also moving towards a more sustainable future for the urban environment by promoting "development practices that result in buildings that are healthier to occupy, less expensive to operate and more responsible to the environment than traditional buildings" (City of Chicago 2010a, n.p.)

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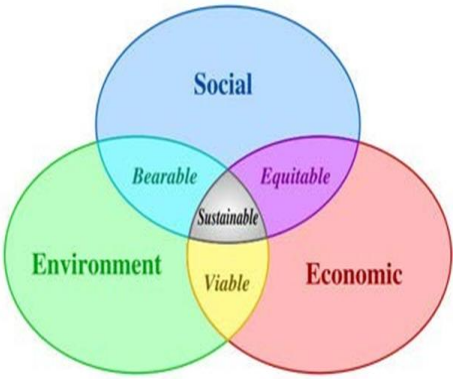


13. Factors impacting adoption:

As a result of the increased interest in sustainable design and green building concepts and practices, a number of organizations, such as those that have been described above, have developed standards, codes and rating systems that encourage government regulators, building professionals and consumers to accept these design concepts, simply by supporting their advantages. In some instances, codes are created so that local governments can adopt sustainable design as bylaws to reduce the local environmental impact of buildings and the landscape (International Code Council 2014).

LEED has stimulated hundreds of laws, incentive programs and administrative policies at all levels of government nationwide, and depending on the location for the use of a green building, rewards for adopting a sustainable building plan might include accelerated permitting, tax credits, fee reductions or waivers, grants, and/or even technical and marketing assistance (USGBC 2014). For these sustainable factors and rewards to take effect, implementers must first choose from the five available rating systems, which are each developed with various requirements that address the unique needs of building and project types on the path towards LEED certification. These five rating systems are: Building Design and Construction, Interior Design and Construction, Building Operations and Maintenance, Neighborhood Development, and Homes (USGBC 2014). In addition, the number of total points obtained in a project determines the level of LEED certification that the project will receive, from the lowest level of 'Certified' to 'Silver' to 'Gold', and finally 'Platinum'. Overall, the LEED program is an immense infrastructure developed to support the leaders in the industry of green building and to increase the possibility of innovating and creating cutting-edge, high performance buildings (USGBC2014).

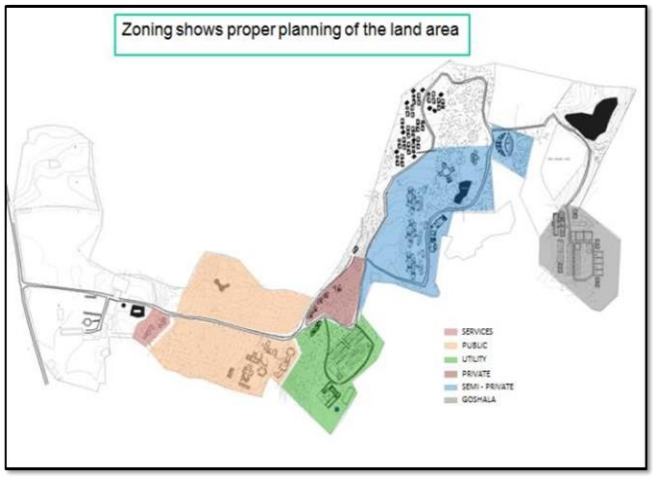
Conformance to GRIHA certification

- To comply with the GRIHA norms the following considerations have to be fulfilled –
- Preserve and protect the landscape during construction
- Proper topsoil laying, stabilization of the soil, and maintenance of adequate fertility of the soil
- Reduce air pollution during construction
- Reduce landscape water requirement
- Reduce building water use by applying low-flow fixtures
- Optimize building design to reduce the conventional energy demand
- Optimize the energy performance of the building within specified comfort limits
- Renewable energy utilization
- Renewable-energy-based water heating system
- Waste-water treatment using SBT
- Water recycle and reuse
- Reduction in waste during construction
- Resource recovery from waste
- Minimize ozone-depleting substances
- Minimize the disruption of the natural ecosystem
- Meet minimum allowable luminous efficacy
- Minimize road and pedestrian length by appropriate planning

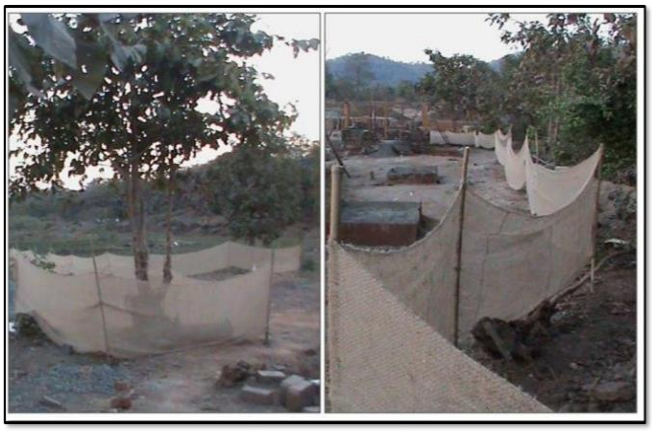
14. Construction Process-

We will now walk through the sequence of construction activities in GEV.

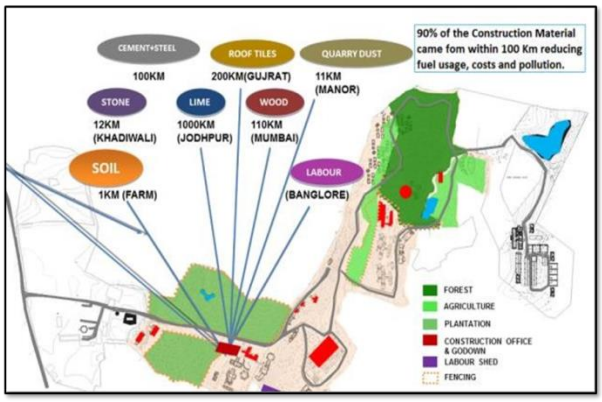
Stage 1 – Zoning



Stage 2 – Protecting existing ecology



Stage 3- Smart Sourcing

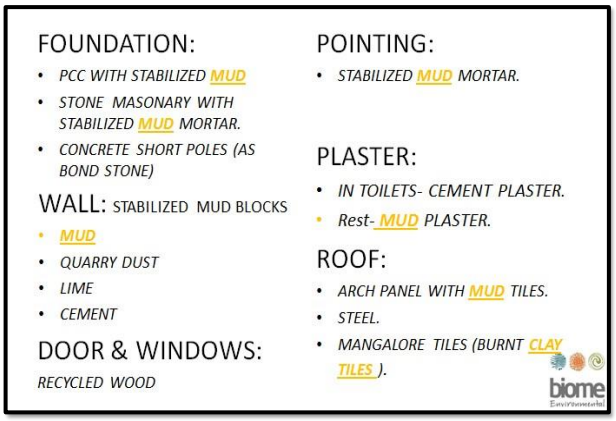


Stage 4 – Zoned Construction

Construction activity was not allowed to spread all throughout the campus. It was restricted to only some areas with all the brick production units strategically placed near those areas to minimize transportation

Stage 5 – Mud is the essence

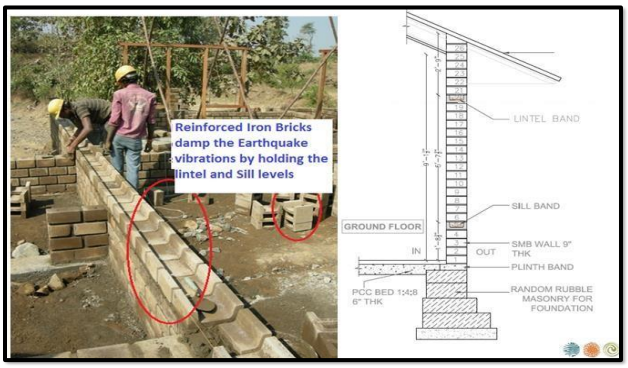
Simple, Natural Mud was the key constituent of the construction material



Stage 6 – Earthquake resistance

The GEV lies in the zone with a remote chance of an earthquake. Conforming to the BIS

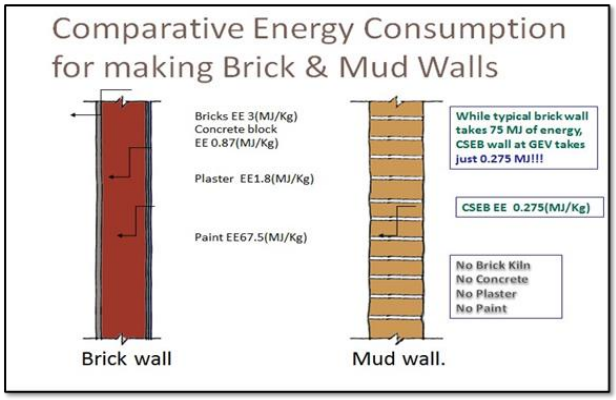
Norms, we have prepared earthquake proofing methods to secure our buildings.



Stage 7 – CSEB v/s Conventional Fired Bricks

Lesser amount of energy is consumed in preparing the Compressed Stabilized Earth

Blocks as against the modern day bricks used in construction.

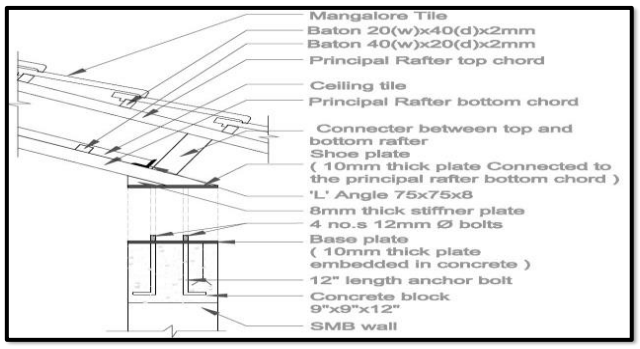


Stage 8 – Assembled Arches Advantages of Assembled Arch Panel:

Saves cost on RCC, Saves cost on plastering ceiling with cement. Saves wastes in plastering ceiling with cement as lot of cement falls down during plastering.

Stage 9 – Natural Insulation

A sloped roof with double layer of Mangalore tiles with an air gap between the two layers as insulation. It ensures that the temperature inside the room is moderate as compared to outside.



15. Conclusion:

Green, or sustainable, building is the practice of developing and implementing healthier, more resource-efficient models of construction, renovation, operation, maintenance and demolition. To many of us, designing for sustainability has been defined into an industrial concept of economic prosperity, environmental quality and social equality (Elkington 1998). Since the inclusion of the term sustainable development, the well-known definition was created in the Brundtland Report: Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, n.p.). At this point in time, the United States participates in various organizations advocating polices and laws at all levels of government nationwide for the growth of green building, while also offering developers and homeowners financial and structural incentives to support local community development and education in sustainable practices and green building design (International Code Council 2014, USGBC 2014). At the forefront of this movement is the USGBC. In addition, as endorsements and advocacy for educational concepts and other aspects of green building continue to grow, current support and development of additional programs and incentives for green building and sustainable practices can be found from individual supporters and volunteers (AIA 2014, International Code Council 2014, USGBC 2014). In conclusion, green roofs, as a sustainable building practice, provide an opportunity for significant sustainability impacts in areas of growing suburbanization.

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