

Dayananda Sagar Academy of Technology and Management
NATIONAL CONFERENCE ON CONVERGENCE OF SCIENCE, TECHNOLOGY AND
MANAGEMENT NCCSTM - 2016
An endurance through Nature's Conflict

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ABSTRACT

The aim of the study is to throw light upon the Global constructional impact on developed & developing nations. It resolves to curb the prevailing scenarios related to Global Warming in the Architectural Arena for a sustainable future.

Our paper highlights the various building materials to be adopted in construction technology to control over the climate change. It also emphasizes towards the approach of various organizations e.g. LEED (Leadership in Energy and Environmental Design). LEED is a nationally accepted organization for design, operation and construction of high performance green buildings.

Keywords— Sustaining Capacity, Carbon-Footprint, Green House Gas emissions, Zero carbon Architecture, World Meteorological Organization, Natural stone, compressed stabilized earth blocks, earth concrete, climate change, LEED.

I. INTRODUCTION

“I believe in GOD; Only I spell it NATURE” ~ Frank Lloyd Wright.

From the dawn of time, nature with all its ingenuity has selflessly unveiled her humble surface, for the human race to build formidable structures upon. A transition through the boulevard of constructional evolution would hence present us with citations of edge-cutting & trail blazing

inventions in the arena of technological developments.

With these developments & breakthroughs came the discovery of the flipside of this phase. These efforts restrain the Earth’s ‘carrying capacity’; its ability to provide the abundant resources required to sustain life on it, while retaining the capacity to regenerate & remain viable.

II GLOBAL WARMING & ARCHITECTURE

It was previously believed by scientists & environmental theorists alike, which increased CO2 levels would not impact & hasten the process of global warming. Their belief maintained that the ozone absorbed all the available long wave radiations, therefore an additive change in CO2 wouldn’t alter the heat balance of the planet with global warming being a prevailing, escalating challenge to our environment, the call of the how is to switch methodologies, curbing the Carbon-Footprint production & Green House Gases emission. Zero Carbon Architecture (ZCA) is a sought after terminology, to describe buildings with Zero Net energy consumption & C-Emissions annually. In this approach, ZCA can be used autonomously from the energy grid supply- Energy generated on site using renewable sources like



solar, wind; in combination with efficient HVAC & lighting.

Developing countries strive for the right to economically expand the fastest way they can; whereas Developed Nations face the obstacle of deciding between whether to sacrifice economical development at the cost of ecological protocols.

Buildings have a significant impact on the ecological biome. Built forms are alone responsible for 15% of all human Green House Gas emissions. In the year 2015, global Temperature records, rainfall records, devastating droughts, unusual cyclone activity & intense heat waves were recorded. Global surface temperature in 2015 shattered all previous records by a wide margin of 0.76 Deg Celsius. Research done at the Concordia University suggests that 60% of the anthropogenic global warming before 2005 was generated by 7 countries. USA, China, Russia, Brazil, India, Germany & UK are the biggest contributors to manmade. United States was alone responsible for 0.15 Deg Celsius temperature increase (20%) change; Consequently agendas were passed based on elevating energy efficiency, promoting renewable energy, reducing coal emissions & providing assistance to developing countries to strive for higher levels of sustainability. The UK too has been predicted to be impacted by significant climatic change risks like flooding, rise in sea levels, drier and warmer summers. In South Asia, sea level rise, increased cyclonic activity, temperature changes & precipitation patterns. IPCC (International Panel of Climate Control) predicts worldwide temperature change from 0.6-4 Deg Celsius ^[1]. China was responsible for about 10% of global warming. The mitigating climate change & air quality without unintended consequences will require understanding of complex climatic interactions.

III ENVIRONMENTAL MANAGEMENT & PROTECTION

The KYOTO Protocol (2005) ^[2] – By the UN Framework Convention on Climate Change, aims at framing objectives & agendas in the form of a legally binding international agreement, whereby all participating nations commit themselves to tackling the issue of Global warming & Green House Gas Emissions.

EIA- Environmental Impact Assessment ^[3] can broadly be defined as a study of the effects of a proposed project, plan/program on the environment. Established in 1970 by the enactment of the **National Environmental Policy Act (NEPA) - USA**. Most Developing Countries have also embraced it, & are in the process of formalizing EIA through Legislation. EIA Process is necessary in providing an anticipatory & preventive mechanism for environmental management & protection in any development.

IV WORKS OF AR. LAURIE BAKER AND AR. GERARD CUNHA

Works of famous Indian origin architects have been enlightening and profound. Laurie Baker; the father of low cost architecture in India. He was the pioneer of the realm of sustainable & low cost architecture for the mass of the economic society. He believed strongly in the study of one's site, usage of potential services, knowledge of local materials & an honest & truthful approach towards architecture. Major Construction techniques centered about: Use of Rat-Trap bond, Filler Slab, Arches, Corbelling, Terracotta & roofing in similar Media, along with Jaliwork.

St John's Cathedral; Tiruvalla- The church in Kerala is a premier example of the utilization of all of Baker's principles in construction. It is a primarily Christian structure with glimpses in form of the traditional Hindu Temple.



The Interiors are a resounding image of biblical themes around the altar, which gleam with light upon the penetration of the sunlight. The outer walls are a combination of locally available brick and granite, with imposing Mangalore tile roofing.

Gerard De Cunha; An Architect of Indian origin, He's the founder and principal architect of the firm 'Architecture Autonomous'. He is known for utilizing locally available materials & traditional construction techniques in harmony with the environment.

~Nisha's Play School: An Ideal campus for a primary school, located in Goa. Every aspect of this school has been built to align with the requirements of the end users.

- The use of abundant daylight, reduces usage of artificial lighting.
- Fine Brick Architecture
- Massive open & Accessible spaces.
- Extensive use of glass, contributes to making Nisha's Play School an edifice of sustainable Architecture.
- Flooring is of Red & Black Oxide; Cudappa stone shelves, recycled doors & windows.
- Use of green Building Glass ensures reduction of heat penetration.
- Waste Materials in usage

V LOW CARBON EMISSION MATERIALS

Basic construction materials need to be extracted, produced and transported which make buildings both energy and carbon-intensive, so it is critical to select building products and materials which have a lesser carbon impact based on the above criteria. We need to investigate the origin of the raw materials when we consider sustainable materials.

Natural stone, for example, produces minimal emissions during the production process but the transportation from the source to manufacturing site can be the largest cause of emissions, e.g. in transporting from quarries in different parts of India. Concrete on the other hand, releases high levels of carbon emissions during production in comparison to its transportation emissions. In this paper, we study the materials in context of its overall cycle for low carbon emissions.

A Earth as a Material

Building with earth materials (mud construction) greatly reduces the transportation emissions due to the availability of its raw form on site.² Earth as a material is one of the oldest materials which date back to the grain stores of Ramasseum built in adobe in 1300BC; the Great Wall of China has sections built in rammed earth over 2000 years ago. Iran, India, Nepal, Yemen all have examples of ancient cities and large buildings built in various forms of earthen construction.



There are several techniques in earth construction which differ from one another based on their ratios of sand, water and stabilizer. Some of them that are commonly used for construction in the modern context are compressed stabilized earth blocks (CSEB), rammed earth, adobe, cob.



1 - Adobe Bricks - Auroville

2 - Rwandan Education Center

<http://inhabitat.com/incredible-modern-rwandan-education-center-made-with-local-materials/rwanda-education-center-7>





3 - CSEB House - Ecovillage

4 - CSEB Interlocking Pattern

<http://www.ecovillage.org.in/ecopedia/compressed-stabilized-earth-blocks-cseb>



5 - Wendell brunette architects -

Rammed Earth

<http://wendellburnettearchitects.com/>

B Bamboo

Bamboo was looked upon as a primitive material but is now starting to appear in designer homes as flooring, walling and paneling material. It has been in wide usage since ancient times as a low-cost material and is gaining popularity as a low carbon emission material due to its rapid growth, tensile strength and renewability. Extensive research is resulting in complex bamboo construction. Eg green school, bali.

6 - Bamboo cathedral- Pereira

7 - Bamboo Spiral - Green School, Bali.

<http://www.inspirationgreen.com/index.php?q=bamboo-buildings.html#sthash.uj32tNgK.dpuf>

C Earth Concrete

In the process of demolition of modern houses, a series of problems arise. The waste concrete along with reinforcement is throw into landfills and river beds thus increasing the height of the river bed and reducing its life. To combat this, a new building construction technique which is a mixture of demolition concrete and earth is used in construction and is known as earth concrete.

VI THE IDEA OF “UPCYCLING”

“I call it downcycling. They smash bricks, they smash everything. What we need is upcycling where old products are given more value not less.”

-Reiner Pilz

The term Upcycling coined by Reiner Pilz has a very important connotation in relation to carbon emission. Carbon emission on recycling of certain materials might unreasonable high thus making it impractical. Eg. Tetra Pak, it would take more energy to separate the layers of a tetra Pak than to re-use it. This easily available product can be UPCYCLED to a construction material such a green roof sheets. (plastic tetra packs are fused together to form roofing sheets). In this way the waste material has been given higher economic



value and is repurposed reducing its carbon impact.

8 - Roof sheets made out of tetra packs.

<https://internationalhouseauroville.wordpress.com/zero-waste-dormitory/>

9 - Walls made from crushed cans

10 - Upcycling Glass Bottles

11 - House made from crushed cans

<http://how-to-recycle.blogspot.in/2012/09/house-of-recycled-materials.html>



VII LEED

Launched in 1993, when Rick Fedrizzi, Mike Italiano and David Gotfried got together in a proverbial 'garage' to knock around ideas for raising awareness of environmental issues in building and design, which grew more comprehensive and eventually codified into LEED in 1998.

Based on independent assessments of the growing stock of completed LEED projects, results seem to suggest that most users of the program are drawn more to self-serving collateral benefits rather than to implementing methods that lead to measurable environmental improvements.

New York Environmental consultant, Henry Gifford, was so surprised by the poor performance of a LEED certified building of one of his clients that he investigated the source for LEED's claim of 25-30% reductions.

When Gifford analyzed the same sampling and applied appropriate rigor results indicated that the same building actually used 29% more energy as compared to other buildings in the dataset.

A lawsuit was filed but was dismissed later as he failed to indicate how the false advertising harmed him under the Lanthom Act. Nonetheless, his findings are alarming and consistent with subsequent studies.

The June 13, 2013 issue of USA Today, featured an expose on LEED titled 'In US Building Industry, is it too easy to be green?'. The feature unfolds the shameful story of how the Palazzo hotel and Casino in Las Vegas was able to win LEED Certification with points gleaned almost entirely from attributions having little or no contribution to the environment, such as using steel and concrete like most buildings.

The Palazzo's LEED Silver Certification won them a Las Vegas jackpot of 27\$ million in taxpayer paid taxes breaks over 10 years.

Roughly 170 cities give LEED builders tax-breaks, grants, expedited permitting or waivers allowing them to construct larger buildings than local law allows. With such huge awards for so little effort, it is not difficult to see why the program attracts such rent-seeking behaviours.

LEED Certification is overly complicated, time consuming and expensive, adding \$150,000 in taxpayer borne costs for new buildings. The added time and expense help people to accrue significant tax benefits.

LEED has become pro forma, more about earning points than improving the environment.

LEED is insufficiently demanding of it's applicants. However, there is no penalization for avoiding requirements with most onerous impacts on the environment.

Indiscriminate in its weighting of credit points. Installing a bike track outside a building receives the same number of points as redeveloping a brown field site.

LEED's focus on certifying proprietary products rather than defining generic product standards can lead to confusion and give proprietary brands unfair advantage.

No discrimination for location. Creates cookie-cutter green projects that can be placed in any climate, instead of creating a green project that reflects the neighbourhood and region in which it is built.

Points accrued for measures to mitigate cold climate count equally well for projects in warm climate.



VIII CONCLUSION

The industry's growing sustainability ethic is based on the realms of:

- Resource efficiency
- Health
- Productivity
- Newer sustainable technologies.

It takes into account the Building's total economic & environmental impact. A modified environment will not only provide shelter for the end users, but also provides an environment conducive to high performance of all occupant activities. In many cases, focus shifts from qualitative to quantitative aspects. Architects tend to associate sustainable concerns with numerical performances only; detached from issues like comfort, resources or social ethics.

Sustainable design is a complex architectural approach encompassing diverse fields of knowledge and requiring multi-discipline teamwork. A blend of architecture & engineering is seen in the establishment of the green architectural principles. A novel design mindset where nature, society, creators all work in unison to weave a today & a tomorrow in equal partnership in design framework

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