All India Workshop

on

Environmental Laws & Clearances for Construction Projects & High Rise Buildings

January, 6th & 7th 2012

Organised by

The Institution of Engineers (India)
Maharashtra State Centre

In Association With

Environment Department, Government of Maharashtra
Maharashtra Pollution Control Board
Brihanmumbai Municipal Corporation
Navi Mumbai Municipal Corporation

Under the Aegis of
Environmental Engineering Division Board

Organising Secretary

Shri. Subhash Patil,
Convener, Environmental Engineering Division,
& Jt. Hon. Secretary, IE(I) MSC
Mob. 98203 93134/98695 80472

Sponsor : Neelkanth Group

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Two-day Workshop on

Environmental Laws & Clearances for New Construction, Large Development Projects, SEZ, CRZ & High Rise Buildings

On 6th and 7th January, 2012 at the IE (I), Auditorium

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Scheduled Programme

Friday 6th January, 2012

09.00 to 09.30	Registration and Breakfast	
09.30 to 10.00	Inaugural Function	
10.00 to 11.30	**Lecture 1:** Environmental Laws & EIA Notification	Shri. D. T. Devale, Sr. Law Officer, MPCB
11.30 to 11.45	Tea Break	
11.45 to 13.15	**Lecture 2:** Context and Problems of High Rise Development: Environmental and Quality of Life Issues.	Dr. Rakesh Kumar, NEERI, Mumbai
13.15 to 14.00	Lunch	
14.00 to 15.30	**Lecture 3:** EIA of Construction Projects.	Shri. Vishwas Kale Consultant
15.30 to 15.45	Tea Break	
15.45 to 17.15	**Lecture 4:** CRZ Laws and Notifications----Is it Sacrosanct????	Shri. G. D. Chiplunkar Consultant

Saturday 7th January, 2012

09.30 to 10.00	Breakfast	
10.00 to 11.30	**Lecture 5:** Green Buildings Designs	Ms. Roshani Udyawar Head, Rachana Sansads Institute of Environmental Architecture
11.30 to 11.45	Tea Break	
11.45 to 13.15	**Lecture 6:** Rainwater Harvesting Techniques & Their Applicability.	Ms. Suprabha Marathe Executive Engineer, Rainwater Harvesting Cell, M.C.G.M
13.15 to 14.00	Lunch	
14.00 to 15.30	**Lecture 7:** Development Control Regulations for Greater Mumbai.	Shri. Sandip Isore Consultant
15.30 to 15.45	Tea Break	
15.45 to 17.00	**Lecture 8:** An Introduction to Construction Safety	Shri. K. R. Khudanpur Consultant
17.00 to 17.15	**Concluding Sessions:** Brickbats and bouquets	

GREEN BUILDING DESIGN

By ROSHNI UDYAVAR YEHUDA

INTRODUCTION

Indian architecture with a heritage dating back to 2600 B.C. Mohenjadaro and Harrapan civilizations is confronted today with a 'green' agenda. Green buildings, Environmental Architecture and Eco-housing - are different names of the trend towards efficiency and conservation that emerged in the last decade, challenging building codes, materials and even designs used in modern urban architecture. However, the boundaries of Green remain yet undefined, open to interpretation to its many stakeholders.

Green building is one that reduces impact on the environment. Construction of buildings, after all, is second only to agriculture in its impact on the earth's ecosystems. In developed countries, for example, each citizen uses or has used 3.5 tonnes of stone, sand and gravel each year in the form of aggregates, the most common ingredient in the building construction industry. Denatured concrete jungles in our cities are not just visual and psychological eyesores, but at a worldwide consumption rate of 2.5 tonnes per person per year, concrete is second only to our consumption of fresh water. What is more, this consumption has increased 10 fold in the last 50 years. Even with abundantly available local materials, our habitats are monotonously built with concrete and steel, basically mined from the earth and manufactured through an energy-intensive process generating large amounts of Carbon di oxide, contributing to global warming. According to a report in Nature, typically for every tonne of cement produced, 60 – 130 kg of fuel and an additional 110 kWh of electricity are used, and 0.83tonnes of Carbon di oxide are emitted in the atmosphere.

In the last two decades, Green buildings have gained in popularity, thanks to the efforts of architects and environmentalists. As David Pearson states in the introduction to his book, Earth to Spirit: "In many countries around the world, a new architecture is emerging. No longer is it acceptable to inhabit buildings (and cities) that make little or no reference to environmental issues or are patently bad for our health and well-being, let alone our spirit. Buildings built out of the exploitation of the world's scarce resources and polluting the air, water and land with toxic wastes, are tantamount to a rape of the environment. The new architecture will be respectful of nature, caring for health, and nurturing to the spirit - an architecture which puts us again in touch with the primeval forces of life."

GREEN BUILDINGS DEFINITION

The Indian Green Building Council defines a green building as "one which uses less water, optimises energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building."

While Eco-housing defines it as housing that is "eco-friendly and energy efficient using sustainable construction practices, and a healthy and productive indoor environment with lowered use of natural

resource. Eco-housing structures are designed, built, renovated and operated in an ecological and resource efficient manner."

GRIHA defines a green building as one that depletes as little of the natural resources during its construction and operation. The aim of a green building design is to:

- Minimize the demand on non-renewable resources and maximize the utilization efficiency of these resources when in use, and
- Maximize reuse and recycling of available resources
- Utilization of renewable resources.

We may conclude that in the modern urban Indian context, green buildings are considered to be those that use material and energy (fossil fuel) resources efficiently as well as provide a healthy and comfortable indoor environment and have least impact on the immediate surroundings.

GREEN BUILDINGS: PRINCIPLES & PARAMETERS

The basic concepts underlying Green buildings are conservation of resources, simplicity and harmony with nature – all of which will lead to environment sustainability. The use of local materials, for example, suitable to specific climatic conditions reduces the energy consumed in transportation of standardized materials manufactured at distant locations, besides eliminating the greenhouse gas CO_2 emitted during transportation. Green buildings imitate the cycles of nature by eliminating waste. All that is utilized by a building - water, food and other resources - is recycled and reused. Energy is obtained from the elements of nature: sun, wind, geothermal and even biogas produced by composting waste.

So, what is green? And how can we distinguish a green building from a conventional one? The following 6 parameters have been identified to define a green building:

1. **Ecological landscape Design:** Landscape design does not refer to gardens or plantations alone. It is about how you treat the land. The site on which a building is to be constructed has to be thoroughly studied in the context of its macro and micro environment. This implies study of geology, soil conditions, vegetation, fauna, hydrology & drainage of site, etc. The aim is to build in congruence with the existing site, and not against it. Build along the contours, with minimum damage or replacement of vegetation; consider natural drainage and build storm water along the same; do not allow hazardous materials or any form of pollution on the land; as far as possible, do not cut trees and where there is no choice, transplant, especially old, mature and indigenous trees which are not rapidly renewable; protect soil from erosion during and after construction, by water shed management techniques such as contour trenches, check dams, bunds, etc.; protect not only the water resources on the site but also its catchment; recharge and harvest water for long-term water sustainability; plant native species of vegetation and those that require less maintenance and water.

2. **Solar passive design for thermal comfort and low energy footprint:** This means that buildings must be designed in the first place to be suitable to macro and micro climate of the place and rely less on mechanical means of providing thermal comfort to occupants. Understanding the building in context of its surroundings and climate – average temperature, relative humidity, radiation, wind speed and direction, etc. is the first step for the designer. This is critical to reducing energy consumption and carbon emissions.

   Passive solar design or bioclimatic architecture has been an important field of study since the 1960s Victor Olgyay's research on human thermal comfort with the invention of the (temperature and relative humidity) bioclimatic chart. In fact, the practice of bioclimatic architecture dates back to the beginning of agriculture and society almost 10,000 years and is visible in vernacular architecture around the world which was dependent on passive design in the absence of active measures such as lights, fans and air conditioners.

   Knowledge of building physics is a vital tool and skill for an architect while having immense scope for enhancing design and form. It includes the principles of heat and mass transfer in buildings, which is studied with respect to orientation, materials, massing and finishing.

   Building simulation tools such as Ecotect, IES and Energy Plus/Design Builder are tools which allow architects to simulate their buildings to find out if the orientation is ideal, design optimum shading devices, use appropriate building materials and even simulate the actual flow of ventilation and natural light in the building.

3. **Use of eco-friendly building materials:** Eco-friendly materials are those which have low-embodied energy, which do not pollute the environment, have minimum carbon emissions during manufacture and transportation (therefore, locally sourced), do not pollute the indoor environment when in use by emitting Volatile Organic Compounds (VOCs), or give out Suspended Particulate Matter (SPM) or are susceptible to microbial contamination. Eco-friendly materials should be recyclable and also manufactured from recycled materials, should be bio-degradable or natural and not cause contamination at end-of-life.

   The green rating systems have created a new market for materials such as thermally superior glass, insulation and HVAC systems – materials which did not hitherto exist in the supply chain. Estimates by IIT Bombay (Reddy, Embodied Energy in Buildings, Department of Civil Engineering, Indian Institute of Technology, 2002) indicate that the energy for consumption of basic building materials (2500×10^6) is likely to double by 2020. The report also indicates that the use of low-embodied energy building materials such as stabilized soil blocks and brick masonry is 1.35 to 4.25 MJ per brick. As compared to this, the materials used in modern green buildings such as aluminium and glass is 236.8 and 25.8 MJ per kg. Even cement, the most common material used in building construction, has an embodied energy of only 4.5 MJ per kg.

4. **Energy Management:** It has been found that the maximum energy consumption of a building is during use. So, after reducing the possible energy consumption during design stage by passive design – implying appropriate design of fenestrations, wall and roof assemblies, form, etc., systems should be put in place for proper energy management. These include using high efficacy lamps, designing optimum Lighting Power Densities (LPDs), efficient pumps, motors and HVAC systems (where utilized). Further, the energy consumption can be reduced by offsetting part of the consumption using renewable energy sources such as solar water heaters, solar PVs, solar-wind hybrid systems, wind mills, micro-hydel, geothermal and mechanical sources for generating energy.

5. **Water Management:** The entire water balance of the building is to be determined and as far as possible, water should be recycled and reused; fresh water can be supplemented by rainwater harvesting and ground water charging. Black water may be separated from grey water, and treated using decentralized waste water treatment systems. These may be then recycled for flushing or other non-domestic purposes. While grey water could be utilized directly or with minimal treatment for gardening.

6. **Waste Management:** Waste from the building should be recycled to achieve zero-waste system. For this, all waste must be segregated first. Organic waste may be treated in a bio-gas plant (to generate methane and organic fertilizer) or composted to be used in gardening. Recyclable matter such as plastic, paper, metal and glass, may be sent to nearby recycling units. E-waste such as batteries, CDs, semiconductors, etc. must be segregated and sent to E-waste recycling centers.

EVOLUTION OF GREEN BUILDING MOVEMENT

The green building movement in India started in the late 1990s influenced by a world-wide concern for reducing energy, water, material and other natural sources. The architectural community in India, at this time, was largely working within the purview of local bye-laws and designs influenced by the Western world. Exceptions were provided by designers who were trained abroad in energy or environmental design or those whose learning had been influenced by deep-rooted local and cultural context.

The Indian Green Building Council, the nodal agency providing LEED (Leadership in Energy and Environment Design) certification, has registered a footprint of 1 billion square feet since its inception in 2004 while the new national green rating system of India, GRIHA (Green Rating for Integrated Habitat Assessment) has a large number of public and institutional projects in the country registred to its credit since its inception in 2006. This is a remarkable achievement in a brief span of less than a decade. However, there is a need to view this development in a larger and more specific local context. There are a large number of modern buildings which have substantially improved environmental performance but are not certified.

One of India's largest business houses, Godrej, set up the CII-Sohrabji Godrej Green Business Centre (GBC) as a Centre of Excellence of the Confederation of Indian Industry (CII) for Energy Efficiency, Green Buildings, Renewable Energy, Water, Environment and Recycling and Climate Change activities in India. An initiative of the Federal Government of the state of Andhra Pradesh, Indian Industry and House of Godrej with technical support of USAID, it was set up in March 2000 during the visit of the US President, Mr Bill Clinton to India.

The building housing the CII GBC designed by Baroda-based Architect Karan Grover, became the first LEED certified building in India gaining 56 out of 69 possible points. This was the first Platinum-rated building outside of the USA and the third in the world. In 2004, the Centre became the nodal agency for the Indian Green Building Council (IGBC), part of the World Green Building Council (WGBC) 'actively involved in promoting the green building concept in India' and with 'a vision to usher in a green building revolution and facilitate in India emerging as one of the world leaders in green buildings by 2010'.

GREEN RATINGS AND CERTIFICATIONS

The following green rating systems are available for voluntary adoption in India:

Leadership in Energy and Environment Design (LEED): The Indian Green Building Council (IGBC) uses the LEED (Leadership in Energy & Environment Design) rating system developed by the US Green Building Council (USGBC) founded in 1993 by a Stanford Graduate and real-estate developer, David Gottfried, who having reached the pinnacle of his remarkably successful career in real estate, went on to pen the first guidelines for buildings which have now begun to be termed GREEN. The USGBC set up measures for ecological site planning, energy efficiency and improved indoor air quality, water management and waste management in buildings that could be measured and rated. LEED India was a modified version adapted to Indian context by an expert committee set up by the CII GBC in 2004.

Eco-Housing: In 2005, the US Asia Environmental Partnership (USAEP) initiated Eco-housing guideline for residential buildings in India along the lines of the LEED model but adapted to Indian conditions. A team comprising Rachana Sansad's Institute of Environmental Architecture, The Energy Resources Institute (TERI), the Indian Institute of Architects (IIA), Builders Association of India (BAI) and several others, began work on an indigenous green building guideline with the International Institution of Energy Conservation (IIEC) & the University of Pune's Science and Technology Park as implementing agencies. The 'Eco-housing' guideline which was developed as an outcome of this partnership for residential dwellings has been adopted by the Pune municipality. With incentives such as waiving off development and property charges for developers and better interest rates in home loans for customers, it is suitable for residential buildings for the composite climate of Pune. In August 2009, Eco-housing under the IIEC released its second version of guidelines for five climatic zones of India.

Green Rating for Integrated Habitat Assessment (GRIHA): Meanwhile, the government of India has adopted GRIHA (Green Rating for Integrated Habitat Assessment) as the national green building rating system. Conceived by The Energy Resources Institute (TERI) and developed by the Ministry of New and

Renewable Energy Sources, Govt. of India, GRIHA meaning 'abode' in Sanskrit, was established in 2006 to rate new buildings for their environmental impact during three stages – pre-construction, building planning & construction and building maintenance stage. The Indian Govt. provides economic incentives for architects and developers as well as clients for efficient design and use of renewable energy sources through the rating system.

The Energy Conservation Building Code (ECBC), formally launched by the Bureau of Energy Efficiency (BEE), a part of the Ministry of Power, Government of India, in collaboration with the United States Agency for International Development (USAID), in May 2007, is policy measure to reduce the adverse impact of buildings on environment with specific reference to energy use to meet the goals of India's Eleventh Five Year Plan. Buildings that comply with this code feature reduced energy demand and efficient use of energy without compromising on crucial aspects like building function and human comfort; they in fact, contribute to better health and productivity of the occupants.

Buildings and the building industry can save significantly on energy costs through regulation of energy consumption levels in buildings. The ECBC provides prescriptive and performance-based mechanism to reduce energy use in buildings. Energy modelling and simulation which are primary tools for ECBC, provide advance feedback to architects on the implications of different design decisions on the energy performance of buildings along with maximum freedom for creative design and cost-effectiveness.

STRUCTURE OF GREEN BUILDING RATING SYSTEMS:

The LEED rating system on green buildings encompass six topics which include site planning, energy and atmosphere, water efficiency, indoor air quality, waste management and innovation in technology, the LEED rating system offers 69 points. Achieving a minimum of 26 points will provide a basic certification, 33 points a silver rating, 39 a gold rating and 52 a platinum rating. Most rating systems have a star rating or point system categorized under the major parameters of site, energy, water, waste, indoor air and innovation. Eco-housing and GRIHA provide flexibility to include passive design of buildings.

LEED differs from other systems in its flexibility and performance-based criteria. Starting from Commercial buildings, the rating system is now applicable for all types of buildings and projects such as institutional, core and shell, residential and interior as well as architectural and township projects.

The British Research Establishment's Environment Assessment Method or BREEAM is a predecessor practiced in Europe. Australia's Green Globe is another rating system gaining ground. Then, there are rating systems such as Energy Star which are limited to energy efficient equipments and devices, and Ecotel, which is limited to the hospitality industry.

The McGraw Hill Construction, a strategic partner of the USGBC published a report on the 'Global Green Building Trends' in 2008. The Report based on a survey of early market adopters and construction industry professionals in 45 countries had some interesting revelations:

- Nearly one-third or 32% of industry professionals perceive that green already makes up more than 10% of domestic construction output.
- Two-thirds (67%) of responding firms were currently dedicated to green on at least 16% of their projects
- Europe currently has the highest level of market activity, with 44% of responding firms building green on over 60% of projects.
- By 2013, 94% of responding firms will be building green on at least 16% of projects. More than half (53%) will be largely dedicated, building green on more than 60% of projects.
- The fastest green building market is in Asia, where the population of firms largely dedicated to green will nearly triple between 2008 and 2013 (from 26% to 73%).

Critics of the modern rating systems for green buildings state that the country's vernacular architecture is more than Green. Built to context they present local solutions to global issues. From the Chettinad houses of South India to Wadas of Western India, Bungas and Havelis of Rajasthan, present an array of structures whose design has evolved over millennia, which are bio-climatically responsive and culturally sensitive. Many point out that modern rating systems such as LEED presuppose a conditioned building which by itself is a huge energy guzzler and emitter of greenhouse gas emissions.

So, while we toil to 'reduce heat gain' and 'maintain ventilation rates' as per the norms of a rating system, we must bear in mind that what is at stake is the earth itself and the human race. David Gottfried, the founder of the USGBC (United States Green Building Council) in his book, Greed to Green states: "Sustainability is about the two most complex systems on earth – human and living systems. The interrelationship between these two systems marks every person's existence and underlines the rise and fall of every civilization. Historically, no civilization has reversed its tracks with respect to the environment but rather has declined and disappeared because it forfeited its own habitat. For the first time in history, a civilization – its people, companies and governments – are trying to arrest this slide and understand how to live on earth. This is watershed in human existence."

"It's about preserving the future," says Wendy Sommer, program manager with the Alameda County Waste Management Authority in the United States, which recently published a set of guidelines for green building and remodeling. These guidelines encourage developers to build with the finite nature of many resources in mind. Builders are given points for building on an east-west axis, for example, as it allows maximum sunlight reducing on the electricity demand for heating, which in turn reduces pollution. Even corporate buildings need no longer have a glass façade sealing humans from nature, as the Shacklee Corporation in Pleasontson, California, has demonstrated. With adequate daylight, the company was able to turn off 70% of its lights during the energy crises and save on its electricity bill.

(Roshni Udyavar Yehuda is Head, Rachana Sansad Institute of Environmental Architecture & Editor, Evergreen RACHANA, quarterly magazine of Rachana Sansad)