

Increasing Productivity in Conventional Buildings by Implementing Indoor Environmental Quality

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ABSTRACT

The Green Building' concept is gaining importance in various countries, including India. These are buildings that ensure that waste is minimized at every stage during the construction and operation of the building, resulting in low costs, according to experts in the technology. This study focuses on defining green buildings and elaborating their interaction with the environment, energy, and indoor air quality and ventilation. Additionally, the study highlights the green buildings rating systems, the economics of green buildings, and the challenges that face the implementation. Sustainable development is the challenge of meeting growing human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future life and development. This concept recognizes that meeting long-term human needs will be impossible unless we also conserve the earth's natural physical, chemical, and biological systems.

Keywords : Indoor Environmental Quality, Conventional Buildings, Green Buildings, Natural Physical, Chemical, And Biological Systems

I. INTRODUCTION

1.1 GENERAL

The concept of green building has created an immense importance in a developing country like INDIA. The theory implies of minimizing the wastage and the cost of construction. With increase in urbanization the natural resources were used in improper ways which leads us towards the implementation of green buildings and the concept helps in making optimum use of natural resources. The techniques associated with the 'Green Building' include measures to prevent erosion of soil, rainwater harvesting, and preparation of landscapes to reduce heat, reduction in usage of potable water, recycling of waste water and use of world class energy efficient practices.

1.2 GREEN BUILDINGS

Green Buildings (also known as sustainable building) refers to both a structure and the using of processes that are environmentally responsible and resource efficient throughout a building's life cycle. The common objective of green buildings is to reduce the overall impact of the built environment on human health and the natural environment by:

- ✓ Efficiently using energy, water, and other resources
- ✓ Protecting occupant health and improving employee productivity.
- ✓ Reducing waste, pollution and environmental degradation.

The green building is an eco-friendly component, since it is based on the basic rule – "REDUCE, REUSE, RECYCLE". Eventually, the green buildings affords a high level of economic and engineering

performance, which leads us to the betterment of future generation.

1.3 PURPOSE OF GREEN BUILDINGS

With increasing urbanization, natural resources are being utilized rapidly and erratically without any planning and equivalent replenishment. Hence, nature's basic rule is to be adopted, 'Reduce, reuse and recycle', i.e., **reduce the requirement, reuse the waste and recycle to use**. There are many green building rating systems in place. **GRIHA** (Green Rating for Integrated Habitat Assessment) and **LEED** (Leadership in Energy and Environment Design) was developed in response to this need. The **GRIHA** is considered as **Indian National Rating System** which have been finalized after incorporating various modifications suggested by a group of architects and experts. United States Green Building Council administered (**LEED**) as the leading green building rating system which is **ranked first among other systems**.

II. INDOOR ENVIRONMENT QUALITY

The Indoor Environmental Quality (IEQ), one of the five environmental categories, was created to provide comfort, well-being, and productivity of occupants. The LEED IEQ category addresses design and construction guidelines especially: indoor air quality (IAQ), thermal quality, and lighting quality. There is no clear definition for Indoor Environmental Quality (IEQ). Basically, IEQ was expressed in term of occupants' health determined by environmental aspects like Indoor Air Quality (IAQ), thermal comfort, acoustical quality and visual or lighting quality.

Indoor environmental quality (IEQ) is rarely considered as a priority in most development planning and management. **IEQ elements cover 21% of green building evaluation criteria for non-residential building such as academic buildings in higher education intuitions**. Normal person spend 90% of the time in the building either in workplace and home, both indoor environmental (IEQ) of home or

workplace are equal importance on human health. IEQ mainly focuses on thermal temperature (°C), relative humidity (%), acoustic comfort measured in decibel (dB), lighting measured in lux level (lux) and Indoor Air Quality (IAQ) (CO₂ concentration level and air speed movement).

Indoor Environmental Quality does not consider psychological effects, individual and physical reasons such as age, diseases and degradation of parts of the human body as these are hard to determine. Whereas, the environmental aspects affecting the IEQ such as thermal comfort, Indoor Air Quality, acoustic quality and lighting quality are the main considerations in order to identify the IEQ of certain space.

2.1 REASON FOR CHOOSING IEQ:

The reason for choosing IEQ is it will be directly related to the occupant's health and well-being. Indoor environment quality has high level of impact on occupant productivity and behavior.

2.2 Factors Identified:

The four main elements of Indoor Environmental Quality are:

- ✓ Indoor air quality (IAQ)
- ✓ Thermal comfort
- ✓ Acoustic comfort
- ✓ Visual comfort

2.3 INDOOR AIR QUALITY (IAQ)

IAQ is a term which refer to the air quality with in around buildings and structures. It relate to the health and comfort of building occupants. IAQ can be affected by gases like Co, Volatile organic compounds, particulates, microbial contaminants. Indoor Air Quality (IAQ) is interrelated to occupants' health and well-being. Health threats such as headache, fatigue, respiratory problems, and irritations or allergies of nose, eyes and throat may arise when the air consisting of pollutants such as biological contaminants, chemicals, particles and aerosols. IAQ is one of the common matters which influences the health of the occupants. The increase

of awareness among the occupants to the IAQ shows that IAQ is one of the most common indoor environmental problems faced by them.

2.3.1 Sick Building Syndrome (SBS):

SBS is a group of health problems that are caused by the indoor environment such as an office building or a dwelling. Closure of natural openings, use of new construction material which are not properly tested and certified, and type of furniture, office equipment (printer, personal computer) could all contribute to SBS. Uncomfortable temperature and humidity, chemical and biological pollution, physical condition, and psycho-social status are some of the factors identified as root causes of SBS. Symptoms experienced by people with SBS include irritation of the eyes, nose, and throat, headache, cough, wheezing, cognitive disturbances, depression, light sensitivity, gastrointestinal distress and other flu like symptoms.

2.3.2 Causes

Poor IEQ Occupants -Disease carriers of allergens. Building components-Materials, finishes, HVAC, VOCs. Outdoor environment-Climate, moisture, outdoor air, combustion, dust particles.

2.3.3 Volatile Organic Compounds (VOC)

VOCs are carbon-containing compounds that are found in many building components and household products. In any indoor environment there can be up to 100 VOCs present at any given time.

2.3.4 Causes

VOCs, readily evaporate at room temperature and at high concentrations cause allergic reactions and health related problems.

2.3.5 Heating, Ventilation, and Air Conditioning Systems (HVAC)

As the name suggest, it takes care of the heating, ventilation, and air conditioning of the air within the building. It is of top most priority to provide a good HVAC to have a good IEQ.

2.3.6 Causes:

Poor design and installation of HVAC system can lead to discomfort in the occupant zone, spread and growth of biological contaminants, and spread of SBS/ BRI.

2.4 THERMAL COMFORT

Thermal comfort is a condition of mind that expresses satisfaction with the thermal environment in which it is located. The main factors that influence thermal comfort are those that determine the heat gain and loss, namely metabolic rate, air temperature, air speed, mean radiant temperature and relative humidity.

Thermal comfort is probably the most important and easily defined parameter of IEQ. For occupants to produce their full capability, their work space needs to be thermally comfortable. Thermal comfort is influenced by six factors four of which that could be classified as environmental parameters include air temperature, mean radiant temperature, air relative humidity and air velocity. The other two are classified as personal factors and include human metabolic rates and insulation through clothing. All these factors needs to be considered at the design phase of the building itself.

III. CONCLUSION

3.1 GENERAL

This paper has documented how occupant comfort and well-being are affected by IEQ. The review of literature has highlighted that the relationship between IEQ and well-being of occupants and relationship of IEQs amongst themselves is quite complex. However, we spend more than 90% of our life indoors, it is important to understand it and act accordingly.

3.2 CONCLUSION

The Factors affecting the Indoor Environmental Quality of the building were identified and a questionnaire was prepared based on the factors

identified. The questionnaire were sent to different companies and responses were received.

Based on the received responses, the occupants in green buildings have more comfort than in conventional buildings. Similarly they don't have any irritations as in the case of occupants in conventional buildings.

3.3 FUTURE WORK

After receiving the response, the responses has to be analyzed using SPSS software.

Then some possible solutions to implement the IEQ in conventional building has to be suggested.

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