

## **Development of Sustainable Construction for Residential Buildings in Pune City**

S. V. Dewalkar<sup>1</sup>, Govindraj Jadhav<sup>2</sup>, Mohit Raptawala<sup>2</sup>, Akshay Shelke<sup>2</sup>, Sagar Gaikwad<sup>2</sup>, Nishant Shinde<sup>2</sup>

<sup>1</sup>(Asst. Prof. Civil department, Sinhgad Academy of Engineering Pune, India)

<sup>2</sup>(U.G Students Civil Department, Sinhgad Academy of Engineering Pune, India)

**Abstract:** Sustainability is not added on to conventional buildings but it lies in the approach of designing and constructing. 'Green' materials include those which are renewable and/or cause the least impact on the environment. The real estate industry is a significant contributor to global warming due to the extensive emissions of greenhouse gases (GHGs) from the materials used in building construction. Thus there is need of green certification to satisfy consumer. No doubt the number of green buildings has increased but, when the percentage of green building is compared with the total construction the number is insignificant. This paper is an attempt to find out the barriers in application of Green Building materials in real estate construction of Pune by survey methodology. Also to better understand the development of sustainable construction as well as to do in systematic manner a rich source of information on research in real estate construction is carried out.

**Keywords:** Pune city, Green building construction, Barriers, Awareness

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### **I. Introduction**

According to global report "India will become world's third largest construction market by 2025, adding 11.5 million homes a year to become a \$ 1 trillion a year market." [1] The present construction industry growth rate is about 7-8% which is contributing about 10-12% of country's national GDP. This tremendous construction industry growth requires large area for development and material demand for construction is also large. This increasing urbanization lead to environmental related crises such as Ozone layer depletion due to increase in greenhouse gases, global warming, deforestation, ecosystem destruction and resource depletion etc.

Hence to preserve natural resources for future generation and development of urbanization in more economical and ecological way sustainable development is necessary. According to Brundtland sustainable development is a "Development that meets the needs of present without compromising the needs of future generation to meet their own needs". After the introduction of Kyoto protocol the importance of carbon credits increased globally. To gain these credits the major footsteps are taken to reduce Green House gases (GHG) emission. The biggest contributor of these GHG is built environment contributing 40% of global carbon dioxide emission [2]. In order to calculate carbon emission of building new techniques were developed one of these techniques is Life Cycle Assessment (LCA). This method focuses on calculation of carbon emission during whole life cycle of building depending upon type of material used in construction. After calculation of embodied carbon of each material aim is to suggest contractor to reduce and replace the major material which have large impact by sustainable and eco-friendly material. This paper aims to represent the present situation of Method of calculation of carbon emission used in construction industry based on questionnaire survey conducted in Pune city.

### **II. Literature Review**

Due to change in environment and increased awareness about the sustainability led the interest of many researchers to this topic. According to Luis Bragance [3] the sustainable design, construction and use of building are based on the evaluation of the environmental pressure, social pressure and economic pressure. His paper shows approaches to the building sustainable assessment. He thinks that the LCA method is only depending upon subjective aspect it does not consider other parameters.

In Rohit Deshmukh [4] research study he found that when we increase the cement content in concrete automatically embodied energy value of concrete get increased. He also studied properties and embodied energy value of green concrete and fly-lime ash brick. According to Cassandra Thiel [5] concrete and steel, the majority represent the excavation and foundation and structural building system represent the highest environment impact. His study analyzed the life cycle environmental phase of Net Zero environmental building.

Asa Jonsson [6] studied various approaches of environmental analysis of building material. She analyzed all approaches based on their nature, overall purpose, and types of data, the object boundaries and the evaluation and interpretation of result. Grace Ding [7] he studied the comparison between the normal building

and sustainable building based on cost and sustainability index. He also developed mathematical model of sustainability index and tested model on industrial and school projects.

### **Why Residential Construction Is Growing In Pune City?**

The Pune city is 2nd largest among the state of Maharashtra. Pune city is well known as for its high education facilities as well as the prosperity. Pune is 7th largest metropolis of India and Pune is known to have major industries and IT hubs .This city is successfully known to gain population in various cultural activities like theater, music, spirituality and many more. All these features play a significant role in order to attract the migrant from all across India. The real estate market for the Pune is seen to have acceleration by Indian government thereby allowing 100% FDI in the construction and in recent smart city project, Pune city is included.

### **Questionnaire Survey**

Survey is most commonly used method in research for collecting the representative data from area of interest. The objectives of questionnaire survey are:-

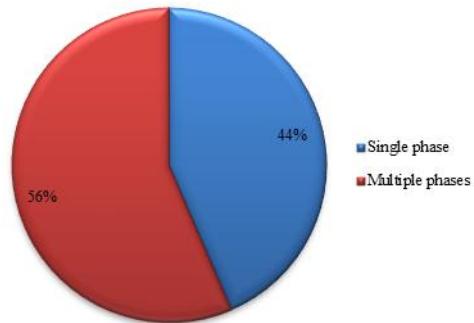
1. To know the awareness about sustainable construction among contractors, architecture, designer and engineer.
2. To know the barrier which are stopping them from using sustainable construction?
3. To find out any software's or tools used on site for calculation of carbon emission of building.
4. To know type of Sustainable material available on project.

Questionnaire survey can be approached by e-mails, Telephonic and in-person.

### **Site Survey Data Analysis**

During our site survey we divided the projects into two categories: single phase and multiple phases i.e. more than two building construction at one site. The number of multiple phase construction in Pune city is more than the single phase. The constructions companies are more interested into invest in multiple constructions at one site. During this survey it is found that the projects which are in single phase category are not much concern about environmental impact of construction activity as compared to multi-phase project. Due to this we are more focused on multiple phase projects.

**Categories of project**



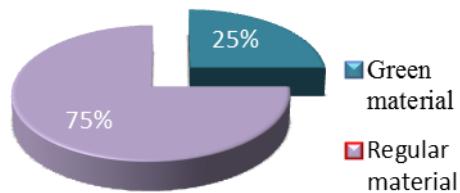
Single phases	Multiple phases
44.00%	56.00%

### **Green material used during construction**

A green building is one which uses less water improves energy efficiency, conserves natural resources, generate less waste and provides healthier spaces for occupants, as compare to a conventional building. As a boost for eco-friendly construction, Pune Municipal Corporation had introduced Eco-Housing assessment criteria for all residential buildings complexes and single family residences. During survey it is found that the projects which are not certified as green building have used eco-friendly material as replacement to conventional material have replacement percentage between 1-25%.

Green material percentage	25%
Regular material percentage	75%

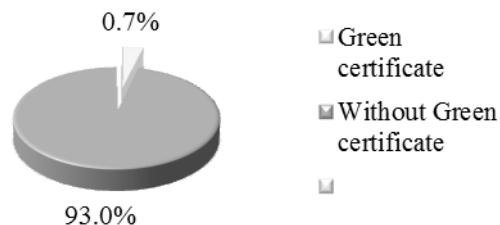
### MATERIAL USED FOR CONSTRUCTION



#### **Percentage of Green Certification in Pune**

There are national level and global level standardization that are monitored through independent bodies to ensure that highest environmental safety and conservation standards are maintained in construction activity. The certificates are granted to construction project based on criteria fixed by standard governing bodies like LEED, GRIHA, ECO-HOUSING, IGBC etc.

#### **Percentage of green certified building**



Green Building certification in Pune City	Percentage
YES	0.7%
NO	93.0%

#### **Barriers which are stopping contractor from implementing sustainable construction**

From this survey it is been observed that in Pune local builders and small scale construction projects are not much aware about carbon emission as well as other harmful Greenhouse gasses emissions from building construction materials and their environmental impact. The reasons behind this are: Multiple criteria and complex rules by governing bodies which leads difficulty for applying, time required for certification process is long, charges of green building consultancies are more, number of software availability is less for calculation purpose of carbon emission of construction building materials, unavailability of sustainable material in market in large verity, Capital cost of green building is quiet more than conventional building.

### **III. Conclusion**

In India, especially the city of real estate hub like Pune, a huge impact can be made by adopting sustainable construction. Although for the environmental awareness the focus is on energy but construction materials have probably the most significance for green economic transformation and the setting up the sustainability. Today's modern building materials have adverse effect on environment in form of carbon emissions thus increasing the awareness and usage of green building materials which are eco-friendly and can contribute

towards a cleaner environment by reducing the amount of GHG and other harmful emission is the need of the hour. The survey was carried out in the region of Pune City of India. We have selected these points for questioner so we could compare the results and come to a generalized conclusion indicating the current situation in the construction industry of this region. Since the construction environment is so complex, our choice of sustainable building constructions wares might differ from other studies.

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