

Planning of Sustainable and Affordable Housing for the Urban Poor in Tier-1 Cities of India

Nadeem A. Sanadi

Assistant Professor

Department of Civil Engineering

Jain College of Engineering Belagavi, Karnataka, India

Abstract— Rapid urbanization has raised the problem of shortage of land in the urban areas along with increasing the impact of the Construction Sector on the environment. This study focus on construction of Affordable Houses to the urban poor of Tier-1 cities of India with an emphasis on proper urban land use and sustainability of the buildings. The study considers studies on various aspects of affordable and sustainable housing such as features, provisions, economy, land-use, planning, and schemes of the Govt. etc. The methodology adopted for the work include Literature survey and overview, Questionnaire survey, forming the problem statement and fixing the objectives and planning of the Project.

Key words: Affordable Housing, Green Buildings, Urban Land Use, Sustainable Housing, Urban Poor, LEED & GRIHA

I. INTRODUCTION

A small house of his own to live is the cherished dream of every individual in our country. Currently 40% of the people are inhabitants of urban areas in India. With increase in the costs of land and real estate it has become difficult for a common man to buy a house of his own. Though the Lower Income Groups (LIG) and Economically Weaker Sections (EWS) have found a dwelling place in cities, they are very much congested and unhygienic.

Affordable housing projects have become the need of the hour because of the increase in demand for housing due to urbanization. This type of housing emphasizes on selection of building materials and use of techniques which meets the need of local conditions in order to improve the quality of life within an affordable budget.

The construction sector is the major contributor to the global Warming. According to GRIHA the building sector is responsible for 40% of energy usage globally. It also accounts for 42% of global water consumption, 30% mineral resource usage and 50% global consumption of raw materials. The construction sector contributes up to 42% of global annual greenhouse gas emission, almost 48% of world's solid waste generation, direct contribution to almost 50% of the air and water pollution, 40% CO₂ emissions, 50% of CFC's (Chlorofluorocarbons) emission and 20% water pollution in the world.

The building sector day by day is increasing its negative impact on the environment. Hence there is a need to find a solution to minimize the usage of all the resources and minimize the emission levels. This can be solved by adopting green buildings techniques. The aim of a green building is to minimize the demand on non-renewable resources, maximize the utilization efficiency of these resources when in use along with encouraging the reuse, recycling, and utilization of renewable resources.

A. Defining Affordable Housing

The definition of Affordable Housing varies from country to country, person to person, place to place and income levels depending upon the emphasis on different parameters like social, cultural, economic etc.

According to RICS report on Urban Housing in India, affordability is defined as “providing ‘adequate shelter’ on sustained basis, ensuring security of tenure within the means of the common urban household”. RICS states that “affordable housing is that provided to those whose needs are not met by the open market”.

B. Defining Green Buildings

In general a Green Building can be defined as the one which uses the processes that are environmentally responsible and resource-efficient throughout a building's life-cycle reducing the negative impact on the environment in terms of use of materials, Water Management, Energy Efficiency Sustainability, Natural Ventilation Reuse and Recycle, Renewable Energy Effective Land Use, Socio Cultural Response, Ecological footprint and Carbon footprint etc.

'According to Ministry of Environment & Forestry, India', Green Building is the “practice of creating structures and using processes that are environmentally responsible and resource efficient throughout the building's life-cycle from sitting to design, construction, operation, maintenance, renovation, and deconstruction.”

The national rating system of India, GRIHA (Green Rating for Integrated Habitat Assessment) in its manual define Green Building as “A building which is designed to minimize the demand on non-renewable resources and depletes the natural resources to a minimum during its construction, operation and maintenance.” According to GRIHA a green building use minimum energy, makes use of natural lightening to the maximum, adopts efficient waste and water management practices and maximize the reuse, recycling and utilization of renewable resources.

C. Affordable Housing in India

In earlier days, development of the housing for the urban poor solely depended on the government. However, in the past few years private sector has started involving itself in construction of affordable housing to the Lower Income Groups (LIG) and Economically Weaker Sections (EWS).

Due to the hike in the price of land within the cities, the affordable housing projects are more seen in the city outskirts where the land prices are affordable. The affordable housing projects in India generally consist of following features.

- Located at about 20-25 km from city center.
- 1BHK or sometimes 2BHK.
- Reduced area – 400-500 sq. feet for 1BHK.

- Construction cost is low.
- Structure is low rise G+3 or G+4 floors without lift.
- Shorter period of construction – 18 to 24 months.
- Basic amenities such as gardens, landscapes are provided.

D. Green Buildings in India

Developers in India till early 2000 were reluctant towards developing Green buildings. For them it was an extra investment since the perception of green buildings being costly ruled their minds. In 2001 IGBC (India Green Building Council) was established because of which the awareness about the benefits of green buildings increased and the green buildings found a place in the Indian market. CII-Godrej GBC Hyderabad inaugurated on 14 July 2004 was India's first green building. Currently Indian market is one of the biggest markets for construction of green buildings. Recent trends in India depict adoption of green buildings to a large extent. "Out of 85 internationally registered projects under LEED NC-USA, 32 (37%) are registered in India (USGBC, 2007). The numbers have grown appreciably in recent years.

E. Union Budget 2016

The Union Budget 2016 has proposed exemption of service tax on construction of affordable houses up to 60 sq. m. under any govt. scheme. The budget also announced deduction on additional interest of Rs.50,000 per annum for loans up to Rs. 35 Lakhs sanctioned in 2016-17, where the cost of the house is not more than Rs. 50 lakhs.

The budget also included 100% tax deduction on profits from a housing project of 30 sq. meters in four metros and 60 sq. meters in other cities. This deduction will be applicable for all the projects sanctioned between June 2016 to March 2019 and should be completed within three years from the date of approval.

This will boost the demand for affordable housing in India and provide more tax benefits to the buyers. Experts say that this will also bring more profit to the developer and attract the investment.

II. PLANNING OF SUSTAINABLE AND AFFORDABLE HOUSING FOR THE URBAN POOR IN TIER - A CITIES OF INDIA - A CASE OF BELAGAVI CITY

A. Need of the Study

Belagavi, the fourth largest city of Karnataka is a major Educational, commercial and industrial hub. Belagavi also has the credit of being called as the Second Capital of the State situated at equidistance from Mumbai, Hyderabad and Bengaluru. The population of the city is growing at a great pace. People of all the classes are migrating to the city which has increased the demand of housing. Whereas the availability of land is depleting day by day. Belagavi has been chosen to be developed as a 'Smart City' under Smart City India mission.

There will be huge requirement of houses and infrastructure facilities to cater the needs of growing population. Hence there is a need to develop houses so that the people of all the classes will have a house of their own. For any developmental activity land requirement will be huge, since the city is at the peak of its growth making proper use of

land should be given importance which can be achieved by encouraging 'Vertical growth'.

The literature study was carried out in order to ascertain behaviors and perceptions of sustainable living, programs to encourage environmentally responsible behavior, designing sustainable housing, energy saving strategies, renewable energy usage, water saving strategies, material use and construction techniques, urban land use etc. Based on the results of the literature review, the research approach outlined below was developed.



Fig. 1: Research Consideration of the project

B. Objectives of the Study

Some of the objectives of the study are briefly listed below.

- To provide a better residence to the urban population in Affordable price.
- To concentrate the scattered population at one place to utilize the other place for more useful purposes by encouraging vertical growth.
- Planning and Designing to reduce the overall impact of the built-up environment on human health and environment.
- Reducing waste, pollution and environmental degradation.
- Ensuring sustainability by using natural materials.
- To make an effort to create awareness about the need of adopting Green Building Technology and Cost effective building techniques.

C. Research Methodology

The working methodology of the study include the following points;

- 1) Literature survey and overview - Referring to research articles, technical papers and reports to understand the concept, need and scope of the project.
- 2) Questionnaire Survey - Questionnaire survey include a set of questions to be answered by the common people and the experts in the field. Depending upon the outcome of the survey the project can be planned and the queries can be answered.
- 3) Data Collection - Collecting the required data and information from the people, concerned authorities etc. to carry out the work.
- 4) Forming the problem statement and fixing the objectives.
- 5) Planning of the Project

D. The Bases of Planning

The study takes into account the following five features namely Refuse, Reduce, Re-use, Recycle and Re-invent to develop affordable and sustainable housing.

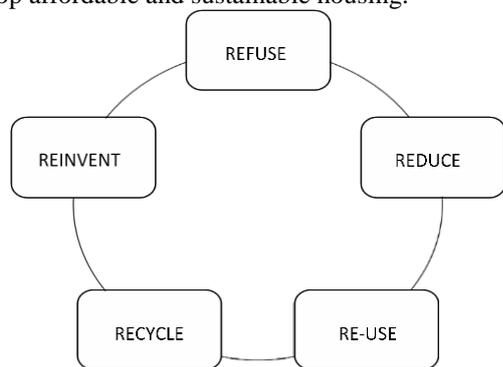


Fig. 2: The 5-R's of Affordability and Sustainability

- 1) Refuse: Refusing time and resource consuming construction methods. Refusing the materials that are to be imported from longer distances and increasing the dependence on local resources.
- 2) Reduce: Reducing use of low quality, high energy consuming and emission causing materials, technologies and equipment's. Reducing as far as possible the reliability on non-renewable sources of energy.
- 3) 3. Reuse: Reusing structurally sound construction materials obtained from various sources such as demolition of structures.
- 4) 4. Recycle: Recycling of various materials, components, water and wastes generated at the site of construction or obtained from demolition of structures or from scrap contribute to the economy without compromising with the strength.
- 5) 5. Reinvent: Reinventing involves obtaining the energy from natural and renewable sources. On-site energy generation using wind energy, solar energy, biogas, rain water harvesting etc.

III. PLANNING CONSIDERATIONS

By considering all the above mentioned bases of Planning, the planning of the case study adopted for the project is broadly classified into the following seven categories.

- A. Sustainable site selection.
- B. Site planning and landscaping
- C. Building Envelope Design
- D. Building Energy System Design
- E. Sustainable Building Materials and Technologies
- F. Water and Waste Management
- G. Indoor and Outdoor Environment Quality

A. Sustainable Site Selection

Selection of most appropriate site is the first and foremost criterion of GRIHA (Green Rating for Integrated Habitat Assessment) rating for construction of sustainable habitat. It is very important to identify and analyze the site and its features. The site that undergo minimum disruptions and interventions during the phase of construction is known as the most sustainable site. Such site will cause least damage to the existing landscape. The developments taking place at the site should not cause or cause minimum damage to the

surroundings besides should improve the quality of the surroundings. Therefore according to NBC 2005, selection of the most appropriate site should be carried out on the basis of 'Preservation and optimal use of the environment, Land use, Development intensity and Social well-being'.

Other important features like approach to the market place, public transport, Schools, Colleges etc. should be taken into account.

B. Site Planning and Landscaping

For achieving better resource efficiency it is important to adopt proper site planning techniques, make maximum use of land, reduce vehicular pollution on site, provide proper lightening, circulation, drainage and basic amenities and many more required factors.

Site planning and landscaping has several rules and regulations to be followed. These regulations change from place to place. 'The Zonal Code' of Belagavi for Master Plan 2021 (Revision II) by the City Corporation Belagavi is the official book of rules and regulations followed while planning. Facilities like a playground, community hall, park, jogging track, water and sewage treatment plants etc. are to be considered in planning.

1) Planning of the dwelling units

After studying the concepts of affordable housing, Government's initiatives for construction of affordable housing it was decided to restrict the built up area of the house to 600 sq. ft. each. With several prepared plans the adopted plan consists of a living room cum dining hall, a kitchen, 2 bed rooms with balconies, amenities and utility spaces. The following table shows the dimensions of the rooms, doors, windows and balconies provided. Each tower will consists of two houses in each floor sharing a common staircase. Every tower consists of 8 houses in G+3 floors to restrict the height criterion.

C. Building Envelope Design

The purpose of the envelope is to provide thermal comfort and protection from the outer environment. It is in general is a physical barrier between exterior and interior of the building. Type of envelope to be adopted vary from climate to climate and place to place.

The Envelope designing materials and techniques like Low VOC paints, High reflective paints, Coating of the walls with any of the ECBC (Energy Conservation Building Code) compliant insulating materials, ECBC compliant glazing window panes, ECBC compliant roofs with insulation, High Performance windows, Green roofs etc. can be used.

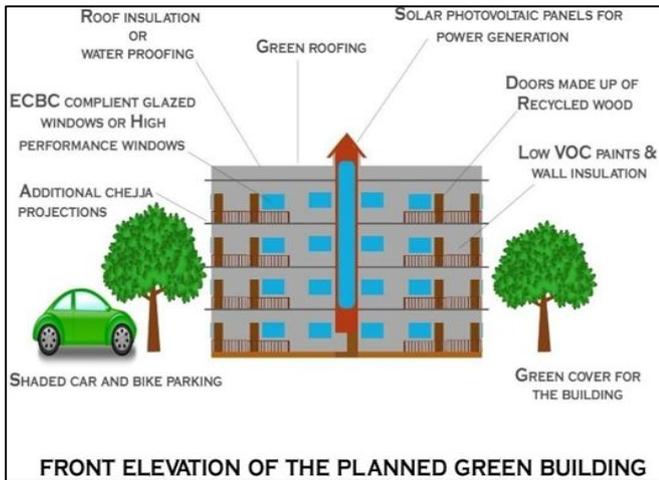


Fig. 3: Front Elevation of the Planned Building

D. Building Energy System Design

Majority of the energy in a building is consumed for Lightening, Heating, Ventilating and Air-conditioning (HVAC). It accounts for approximately 70% of the energy consumption. Green buildings adopt a proper blend of Active and Passive design strategies to optimize the energy use without compromising with the comfort. Passive design strategy makes use of ambient sources of energy whereas Active design strategies makes use of purchased sources of energy such as electricity. To optimize the building's energy demands following passive strategies can be adopted.

- 1) Proper orientation of the building
- 2) Make maximum use of day light
- 3) Building insulation
- 4) On-site energy generation
- 5) Encouraging the use of Renewable energy sources
- 6) Outdoor lightening system
- 7) Using of Energy efficient equipment's
- 8) Reduce the dependency on fossil fuels and conventional sources of energy
- 9) Energy efficient lightening
- 10) Solar based Water heating
- 11) Bio-gas Plant



Fig. 4: Features of the Planned Green Building

Rooftop solar photovoltaic panels for renewable energy generation

- 1) Solar water heater
- 2) Shaded parking for private vehicles
- 3) Green envelope for the building
- 4) Road pavement
- 5) Pedestrian walkway
- 6) Native shrubs or lawn
- 7) Waterproofing and Green roofing
- 8) Waterproofing and Green roofing

E. Sustainable Building Materials

Building materials play a major role in increasing or decreasing the cost of the project. Proper selection of materials will improve the features of the building with respect to strength, durability, appearance, comfort etc. Green buildings are making efforts to use sustainable low cost building materials. These materials are more beneficial compared to conventional building materials. With the advent of green building construction in India, the green building materials are also widely available in the market these days. Use of locally available resources for construction can also be called as sustainable building materials. These materials have least impact on the environment and least embodied energy.

For construction of a green buildings selection of the materials is of prime importance. Materials being used should be low emission causing low energy materials, should have low embodied energy etc. Recycled materials, materials from renewable sources and Building Code (NBC/ECBC) compliant construction materials should be given first preference. Hollow concrete blocks, Cellular light weight concrete blocks, Eco-friendly concrete (EFC), Fly ash – Sand- Lime – Gypsum bricks, Compressed earth - Fly ash – Sand – Lime – Gypsum bricks, Marble slurry bricks, Ferrocement wall panels, Low VOC paints, sealants and adhesives, Recyclable and Salvage materials, Locally available materials, Recycled Steel, Precast Hollow slab roofing, Natural Fiber's such as Rice husk, Coconut Husk, Jute fiber, fly ash etc. are some of the sustainable building material which can be used for the construction of houses.

1) Energy Efficient Technologies

Sustainability and technology go hand in hand. With the advent of technology there are many new things that have come to the mainstream with which the buildings these days are becoming smart. These technologies do not just increase the efficiency of the buildings but also yield better strength, fastens the construction work, reduce the volume of work etc. Some of the feasible and efficient building techniques are Pre-cast technology, Filler Slab Technology, Mivan Aluform Technology, Rat trap system of walling etc.

F. Water and Waste Management

Buildings consume 42% of the global water consumption. It also contributes to 20% of the global water pollution. This takes into account the water required for the construction, operation and maintenance of the building. It is very necessary these days to consider usage and management of water as an entity of prime importance. About 20-30% reduction in the water usage compared to conventional buildings can be achieved with adoption of green building

practices. Green buildings make optimum use of water for operation of the building. A large amount of water requirement is met on site itself by recycling and reuse of water, which can be achieved by employing the following proposals - Water efficient plumbing, Rain water storage tanks, Rain water harvesting pits, and Water meter installation.

1) Waste Management

Waste generation is an unavoidable aspect wherever houses are located. There is a need to employ an efficient collection, storage, disposal and treatment of the waste at site to provide a healthy environment. Worldwide construction sector contributes to a total of 48% of solid waste generation and in India the amount of waste generation from building industry is 25%. The generation of such a huge amount of waste requires an extremely efficient waste management system. Increasing population in urban areas have also increased the problem of waste segregation, treatment and disposal of wastes.

Studies tell that the solid waste generated from the houses consists of 30-55% of bio- degradable organic matter, 20-35% of inert waste and 5-15% if recyclable waste. Sewage Treatment plant, Organic manure using compost bins, Biogas plant, Dustbins with different color codes for collecting different categories of wastes, Recycling and using of building waste can contribute in efficient management of the generated wastes.

G. Indoor and Outdoor Environment Quality

Indoor Environment Quality (IEQ) is defined as the quality of the environment in and around the building in regard of health and wellbeing of the occupants. It considers various factors such as quality of the air, emission by the buildings, waste generation and disposal, noise level, lightening etc. Better the quality of the environment better will be the life and comfort to the occupants.

70-80% of the spaces in all the buildings should be illuminated by natural light. Necessary ventilations and insulations are to be proposed to ensure better thermal comfort even in the absence of air-conditioning. Use of energy efficient equipment's, low energy low emission materials, proper waste management and disposal, provision for maximum green spaces will definitely provide an improved quality of life to the occupants and also protects occupant health and safety. Use of solar water heaters will eliminate the use of wood based heating of water and hence limit the air pollution.

Noise is one of the most disturbing factor that disrupts the comfort at living areas. Noise pollution has become an integral part of the growing cities. To provide occupant a pleasant stay, it is necessary to consider the need to minimize indoor and outdoor noise levels.

Other factors considered to promise a better indoor and outdoor environment quality are provision for valued aesthetics, better building operation and maintenance practices, stores for basic needs, assured privacy to the occupants, adequate space and facilities for recreation etc.

IV. SUGGESTIONS

- The existing green buildings or buildings following green practices should be recognized and appreciated.
- Sustainable building practices should be made mandatory on large sized projects.
- The Government should take necessary measures to transform all government buildings into green structures.
- Green and affordable building projects should be given some allowances such as extra coverage area, Floor Area Ratio (FAR) etc. This will encourage the builders, developers and contractors community to undertake affordable and green building projects.
- Incentives and subsidies should be given to buildings and building practices following sustainability.
- A fast track approach should be introduced where the proposed green and affordable housing projects will get all the approvals and permissions in very less duration.
- Government's Smart City Mission should make green practices a mandatory criteria.

V. CONCLUSION

The government's initiatives for construction of Affordable Housing should be made simple so that they will reach millions of families and provide them with a decent living.

The unplanned growth of urban regions has led to increase in development far away from the city center. This can be eliminated by making proper use of urban land and vertical development.

Accepting the responsibilities towards the environment, adoption of green building practices should be given preference. Green buildings will not only contribute towards the environment but also reduce the operational cost of the building for long run. Achieving energy efficiency in building will lead to smart and sustainable growth. The paper has emphasized on using green practices, cost-effective building techniques and materials.

The project has satisfactorily fulfilled all its objectives and has efficiently implemented its research considerations.

REFERENCES

- [1] Sukanya Ghosh, Dr. Souvanic Roy, "Complexities of Governmental Affordable Housing Programs for Urban Poor in slums of India", *International Journal of Science and Research*, Volume 5. Issue 1, Paper ID: NOV152866, January 2016.
- [2] Deepti Pande Rana, Dr. Arun Kumar Rana, "Core Issues and Challenges of Affordable Housing in India", *Indian Journal of Applied Research*, Volume 6, Issue 1, January 2016.
- [3] Devarshi Tathagat, Dr. Ramesh D. Dod, "Role of Green Buildings in Sustainable Constructon - Need, Challenges and Scope in the Indian Scenario", *IOSR Journal of Mechanical and Civil Engineering*, Volume 12, Issue 2, Ver. II, Mar-Apr 2015.
- [4] Rabi Ahamed. M, Govindaswamy T, "Sustainable Buildings - Politics, Practices and Promotional Prospects in India", *International Journal on Engineering*

Technology and Sciences, Volume 1, Issue 8, December 2014.

- [5] Swaptik Chowdhury, Sangeeta Roy, "Prospects of Low Cost Housing in India", *Geo materials, Scientific and Research*, April 2013.
- [6] Dheeraj Satnandani, "Affordable Housing in India", SBST, CEPT University 2012.

