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Housing for All in Urban & Rural Areas

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आधुनिक तकनीक सुरक्षित निर्माण

INDIAN BUILDINGS CONGRESS

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Phone No: 011- 26169531, 26170197
Fax No: 011-26196391
E-mail: info@ibc.org.in, indianbldgscongress@gmail.com
Website: www.ibc.org.in

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Phone: Mob : 9311661244, 9811759739
Email: shrikrishnakirpa63@gmail.com

FOREWORD

Shelter is the basic human requirement. Even after 70 years of independence, our country is still grappling with the growing shelter problem, especially of the poor. Housing is a major problem world over and is more acute in India. The two main reasons for this are the higher rate of growth of population and secondly the rapid industrialization and the consequent growing urbanization. Well-developed urban centers are great drivers of economy. And, the problem of shortage of housing has further been compounded by the rapid increase in urban population. Constant migration of rural population to cities in search of jobs is causing unbearable strain on urban housing and basic services.The situation in villages is no different with huge shortage of appropriate housing. Unless urgent measurers are taken, both at National and States levels, to mitigate the housing problem, it will assume crisis proportions with adverse consequences on the well being of the people, as well as the process of economic and social development of country.

The present Government is serious to tackle the problem of Housing for All. It has launched two separate schemes. The first scheme is for urban areas. Pradhan Manti AwasYojana (Urban) is an initiative in which affordable housing will be provided to the urban poor. Under this, it is proposed to build two crore houses for urban poor and economically weaker sections by the year 2022. This mission has four components viz. in-situ slum redevelopment with the private sector participation using land as resource, affordable housing through credit linked subsidy, affordable housing in partnership with private and public sector and beneficiary led house construction /enhancement. The second scheme launched is 'Housing for All' in rural areas, under which Government intends to provide an environmentally safe and secure pucca house to every rural household by 2022. Named the Pradhan Mantri Awas Yojana (Gramin), in its first phase the target is to complete one crore houses by March 2019. The programme provides for over 200 different housing designs across the country based on a detailed study of housing typologies, environmental hazards and the households' requirements. A large-scale use of local materials is envisaged.

High expectation of the masses and the call from Government for providing a large chunk of houses in a short time is a big challenge for the technocrats.The implications of the various factors on housing along with related aspects are proposed to be identified, deliberated upon and analyzed with a view to propagate awareness on the subject. It is hoped that useful recommendations shall emerge out of the deliberations, which will be of great value to the professionals participating in the Seminar.

(Parimal Rai, IAS)
President, IBC &
Advisor to the Administrator
Chandigarh UT

PREFACE

Housing remains most vital and critical sector for the individuals, community, society, states and nations because of its complexity and large connotations it has in terms of economy, employment, security and quality of life. It is said to be growth escalator and a sector that contributes directly to the quality of life and productivity. Due to its far reaching implications, international human rights law recognizes everyone's right to an adequate standard of living, including housing.

Housing for All by 2022 has been launched in 2015 for making housing affordable for people from every section of society. The scheme is being implemented in 305 cities and towns across nine states. The focus is to make housing affordable for eligible weaker sections (EWS) and low-income group (LIG) and reduce slums. The scheme also includes constructing houses for the slum dwellers under the slum-rehabilitation scheme and providing loans at subsidised rates for the economically weaker sections.

According to the 2011 Census, many rural cities turned urban with an increasing population but still they were still underdeveloped. A large number of slum dwellers were also identified in metros. Encroachments and informal settlements were also a growing menace. 'Housing for All scheme,' as the name suggests, ambitiously targets to eradicate slums and make housing affordable for the economically weaker section by 2022. Previous schemes of similar nature (Rajiv Awas Yojana, Affordable Housing in Partnership) were discontinued to make one comprehensive scheme called the 'Pradhan Mantri Awas Yojana- Housing for All by 2022.' It has partnered with public and private developers to build houses for the ones residing in informal settlements, especially the slums. Housing loan of up to Rs 6 lakh under this 'credit linked subsidy' will be available at a rate of 6.5 per cent for 15 years on houses built under the scheme. Banks have stepped forward to provide home loans at subsidised rates.

JNNURM was a city modernisation scheme started in 2005 on a mission mode for seven years. It targeted the underdeveloped cities with a view to pervasively disseminate urbanization and concentrated on building social and economic infrastructure and provision of basic civic amenities such as water supply, solid waste management, sanitation, better transportation connectivity, redeveloping old cities, etc. under its sub-mission schemes like- Basic Services to the Urban Poor (BSUP), Development Scheme for Small and Medium Towns (UIDSSMT) and Integrated Housing and Slum Development Programme (IHSDP). The sub-missions of JNNRUM were to promote widespread integrated development. According to the Census data collected in 2011, many rural cities had transformed into urban cities due to increase in population rather than migration. A total of 67 such cities became a part of JNNRUM. The scheme was extended till March 2015 to complete continuing projects. A similar city-modernisation scheme AMRUT replaced JNNRUM.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT) was started in 2015 to build gap between infrastructural necessity and their accessibility. 500 cities have been selected on the basis of population, vicinity to main water bodies, tourism interest, hill states/terrain etc. AMRUT focuses on building infrastructure to improve the quality of life like constructing storm water drainage, green spaces, recreational centres, etc. It also ensures direct link to basic amenities such as water supply, sewerage management, and environmental friendly public transport services. AMRUT was introduced after the closure of the JNNRUM. National Urban Livelihood Mission was in 2013 to alleviate urban poverty and homelessness in 790 cities across the country. The focus was on employment and housing with initiatives in respect of skill development, self-employment opportunities, shelter with essential services for the urban poor.

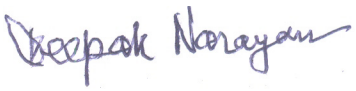
Government of India continued to implement specific infrastructure strengthening programmes towards Rural Infrastructure in sectors like irrigation, rural electrification, rural connectivity and rural drinking water supply. Considering the importance of infrastructure in the sustenance of economic growth of our

country, the GoI had launched a programme on rural infrastructure called 'Bharat Nirman' as a time bound development plan for implementation in four years (2005-2009). The six components included under the programme were irrigation, drinking water, electrification, roads, housing, and rural telephony. This had also sought an active and transparent public and private partnership for immediate execution of various infrastructure related development projects with a mission mode.

The Indira Awas Yojana (IAY) is one of the six components of the Bharat Nirman Programme. In the fiscal year 2011-12, against the physical target of 27.26 lakh houses, 21.18 lakh houses were sanctioned and 7.26 lakh constructed as on end-October 2011. The unit assistance provided to rural below-poverty line (BPL) households for construction of a dwelling unit under the IAY has also been recently revised and construction of IAY houses being brought under the differential rate of interest scheme. The Planning Commission in its Approach Paper to the 12th Five Year Plan (2012-17) pointed out that the Eleventh Plan (2007-2012) witnessed an unprecedented injection of resources from the Union Budget to the rural and farm sector. T his thrust formed the substance of the Bharat Nirman programme.

In the present day context, the theme of the seminar "Housing for All in Urban & Rural Areas" is of great relevance. A total number of 25 papers to be considered in the seminar have been included in the journal. Due to paucity of time, it may not been feasible to include all the papers for presentation in the seminar, all these papers have been covered in the printed journal for ready reference.

The contributions of the learned authors are gratefully acknowledged. It is expected that deliberations would be useful and practical recommendations would emerge which could be implemented to ease the growing demand of affordable housing in urban and rural areas. I would like to thank all the members of the Technical Committee for rendering their help in screening and selection of papers. I gratefully acknowledge the untiring efforts of Shri P. S. Chadha, Consultant, IBC in bringing out this publication.



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Former E-in-C, Delhi PWD

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TECHNICAL SESSION I & II : HOUSING FOR ALL – URBAN & RURAL AREAS

AFFORDABLE HOUSING IN INDIA

Amrit Abhijat* and Richa Rashmi**

Abstract

Urban areas today face multi-faceted challenges of dealing with persistent issues like population growth, changes in family patterns, growing numbers of urban residents living in slums and informal settlements, inadequate urban services and emerging concerns of climate change, exclusion, rising inequality and upsurge in migration. This has resulted in widened housing backlog, aggravated infrastructure deficit and mushrooming of slums and informal settlement. As such, housing has gained paramount importance in the Government policies and private investments.

The Ministry of Housing and Urban Affairs has launched Pradhan Mantri Awas Yojana (Urban) under the Housing for All Mission to ensure that the housing backlogs are bridged and a sustainable ecosystem is created for a self-propelled market to address future concerns systematically. Two years into the scheme, the PMAY (U) has fared phenomenally well and is expected to pace up more to soon realize the agenda of housing for all by 2022. This paper briefs about the PMAY (U) Scheme and its present status, various interventions and future roadmap for the housing sector.

INTRODUCTION

Urbanization is the key driver of growth in an economy resulting in socio-economic transformation, wealth generation, prosperity and development. As per 2011 Census data, India's urban population increased at a compound annual growth rate (CAGR) of 2.8% over 2001-11, resulting in an increase in the level of urbanization from 27.8% to 31.2% during the same period. As per the UN World Urbanization Prospects Report 2014, annual growth in urban population in India between 2010 and 2015 was 1.1% – the highest among the major economies. Furthermore, between 2015 and 2031, the pace of urbanization is likely to increase at a CAGR of 2.1%, which is estimated to be almost double of China's growth rate.This rapid pace of urbanization and ever-increasing population has resulted in a significant shortage of housing across cities in India.There were 0.9 million homeless people in urban India [Census, 2011], in addition to a slum population of roughly 65 million (or 17% of urban India). People from India's rural areas, home to 833 million people, are migrating in large numbers to urban centers. Migrants make up a substantial chunk of India's urban population, last recorded at 35% by the National Sample Survey Organization in 2007-08.The challenges of urbanization manifest as economic gaps in meeting housing needs, sub-optimal level of services and increased infrastructure deficit. In addition, shortages in qualitative deficiency are much larger than those in quantity.

The challenges faced by affordable housing development in India have been multi-dimensional and involves socio-economic, spatial and regulatory issues. On the supply side, scarcity of developed and encumbrance-free urban land, increased cost of construction, growing informal housing options, absence of viable rental market and regulatory restraints have lowered the potential growth of formal affordable housing market. On the demand side, lower purchasing capacity, lack of cheaper loans, inaccessible formal lending options and mismatch of subsidy benefits have long been the cause of lower affordability for securing formal shelter. These issues have magnified over the last few decades with exploding urban population and increased migration. The market has mostly catered for higher income and niche housing resulting in

**Joint Secretary & Mission Director – PMAY , Ministry of Housing & Urban Affairs, New Delhi*
***Knowledge Management Expert, PMAY, Ministry of Housing & Urban Affairs, New Delhi*

decreased rate of new affordable housing stock creation. The replacement rate for obsolete and dilapidated housing stock have not kept pace with the lifecycle of houses resulting in slum-like situation and increased number of housing demand over time. The technological innovations in building material and construction practices lack popularity and acceptance in the market and the continued usage of conventional practices have further retarded the pace of creating housing stock. All these issues put together have resulted in enlarging the total housing shortage in the country. Even with the existing market, practices of opaque pricing, decreased liveable spaces, concealing of correct information and non-enforcement of contracts has weakened the buyers' trust in the sector.

ADDRESSING ISSUES THROUGH RECENT GOVERNMENT INITIATIVES

Managing and facilitating the process of urbanization is essential for India's structural transformation and in the core is the need for affordable housing. In this context, the Government of India in June 2015 launched the ambitious Pradhan Mantri Awas Yojana (Urban) under the Housing for All Mission, which aims to provide a pucca house to every urban household by 2022.The PMAY (U) has sectorally and spatially integrated four verticals, which proposes a twin-track approach: curative, involving improvements to current housing stock through in-situ rehabilitation of slum dwellers (ISSR) and subsidy for individually led construction/ enhancement of houses (BLC); and preventive, involving building new housing stock by providing institutional credit through credit-linked subsidy (CLSS) and affordable housing via a partnership model between the public and private sectors (AHP). The mission verticals, originally designed for the Economically Weaker Section (EWS) and Lower Income Group (LIG) segment, have been protracted to include the Middle Income Group (MIG) as well, thus magnifying the total net of beneficiaries.The grounded projects under Rajiv Awas Yojana have also been subsumed into PMAY (U).

The PMAY (U) has been innovative in incorporating flexibility within the process and empowering the States/ UTs and ULBs to take ground level decisions to enable appropriate and time-bound clearance of projects. Such a comprehensive approach has enabled record number of sanctions of over 26 lakh houses in last two years with a total investment of INR 139,621 crores involving central assistance to the tune of INR 40,613 crores. Out of the total sanctioned strength, construction has started for approximately 10 lakh houses and the beneficiaries have already occupied 3.4 lakh houses. Under CLSS, a subsidy of INR 1038 crores for 52,463 new houses has been released so far (Table 1). The progress is being regularly reviewed with the States/ UTs so as to achieve the objective within the mission period. Usage of geo-tagging feature has also brought more transparency in the progress assessment of the sanctioned projects. Besides, the BLC component has been a revolutionary scheme for non-metro cities given its increased outreach with definitive beneficiaries and reduced gestation period in absence of land titles issues. The scrutiny of Detailed Project Reports at the State level and the flexibility to accord approvals therein have added advantage of lowering the time delays. Collective action and cooperative federalism will not only enable the Scheme to bridge the housing backlog in a time-bound manner but will also help in strengthening the democratic faith and deliverance. Sustainable, resilient and inclusive cities are often the outcome of good governance that encompasses effective leadership; land-use planning; jurisdictional coordination; inclusive citizen participation and efficient financing.

The mission also encompasses a "Technology Sub-Mission" to facilitate adoption of building materials and construction techniques that uses emerging technologies, green and disaster resistant practices, model layout designs and building plans suitable for various geo-climatic zones. This not only ensures faster and cost-effective construction, but also skills a large workforce through capacity building and knowledge dissemination portals. The government has identified 16 new technologies and also constructed technology parks with demonstration housing projects to give practical experience to concerned stakeholders. IITs, NITs and architecture/ planning institutes have been partnered for setting up regional hubs for Technology Submission to enable for research, skilling and institutional support in propagation of modern technologies. States like Andhra Pradesh, Chhattisgarh, Gujarat, Maharashtra, Kerala, Odisha, Jharkhand, Tamil Nadu are using alternate technologies in many

PMAY (U) projects and around 2.6 Lakh houses are currently being built all over India using alternate technologies.More recently to induct innovative construction technologies,the government has launched a "India Housing Construction Technology Challenge" in order to identify and use technologies that are adaptable, scalable, sustainable and pocket friendly.

Table 1: Details of Scheme

Total cities included in mission	4029
Class-I cities included in mission	468
MOU with PLIs for MIG	177
MOU with PLIs for EWS/LIG	229
No of CLSS loan accounts	53,313
No of new houses in CLSS	52,463
CLSS loan subsidy released (In Crores)	1,038.23
Loan account in MIG	2316
Subsidy released in MIG (In Crores)	46.39

As is globally recognized, public sector alone cannot meet the requirements for urban housing including those for the urban poor. Taking forward this agenda, "PPP Models for Affordable Housing" has been designed to tackle the existing implementation issues and allow a self-propelled market to address current challenges. The principal reason for adopting a PPP model for the provision of housing is that, where project suitability is correctly measured and implemented, this approach can offer greater value for money when compared with traditional procurement. Public-private partnerships are designed so that risk is transferred between the public and private sectors, allocating particular project risk to the partner best able to manage that risk cost-effectively. Considering the shortage of marketable land parcels, the government has also framed "Guidelines for utilizing lands of the PSUs" that are declared sick or approved for closure and strategic disinvestment by Government.This will bring such unutilized and underutilized lands under affordable housing and further be made available to the private sector to develop and build affordable housing projects using private capital and efficiencies under suitable PPP structure.

The Economic Survey 2016-17 has emphasized the increased migration in India, which has almost doubled, to an annual flow of nine million a year for 2011-16, from 5.5-6 million a year between 2001-11. Studying this aspect, the erstwhile Ministry of Housing and Urban Poverty Alleviation constituted a "Working Group on Migration" to deliberate upon the impact of migration on housing, infrastructure and livelihoods. The working group in its report suggested the need for rental housing acknowledging, which a "National Urban Rental Housing Policy" along with "Model Tenancy Act" has been drafted so as to catalyze the nascent market for formal rental accommodations. Across the income spectrum, the rental housing allows greater mobility especially for low-income households that often work in the informal sector with volatile income and risk profile. Even though India has traditionally been a freehold ownership based housing market, yet it is access to housing, not ownership that is of primary importance. Repealing Rent Control Acts through adoption of Model Tenancy Act coupled with a fast-track court mechanism to handle eviction disputes can potentially reinvigorate market confidence in rental housing.

It is not only essential to provide the required fillip to market forces but also to create an ecosystem for better functioning of the same. In pursuance of this, the Government has enacted the "Real Estate (Regulation and Development) Act 2016" to usher in greater accountability and transparency from developers, protect interest of consumers and establish speedy grievance redressal mechanisms. Affordable Housing has been accorded 'Infrastructure Status' under the harmonized master list of Infrastructure Subsectors, which has been a long-standing demand of the sector and a provision that was enabled through the incoming of RERA. This measure will facilitate access to low cost and long-term funds for the sector, which when passed on to the consumers, will reduce the cost of affordable housing. The new status will augment resource allocation for the sector, which in turn will boost housing supply and reduce huge demand backlog. This would go a long way as a very critical supply side incentive to bring in private investment in affordable housing sector. Furthering this approach, the Government has also directed the State Governments/ UTs/ ULBs to streamline all approval process through a single window system of obtaining clearances.

Table 2 : Budget Proposals

Demand Side Interventions: (Subsidize the beneficiary/buyer)	Supply Side Interventions: (Subsidize the Housing Unit)
Direct tax benefits	Infrastructure Status to affordable housing
Interest Subvention for MIG	
Refinance Housing Loan for NHB	Liberalization in FDI

The Budget 2016-17 and 2017-18 proposed various measures and improvements (Table 2) to make affordable housing more wide-reaching and providing developers with better credit facilities through fiscal concessions such as direct tax benefits under Section 80-IBA of the Income Tax Act, easy and dedicated access to institutional funding, relaxation in FDI and ECB proposals, and standardized usage of carpet area definition. These interventions will propel the affordable housing market through private sector participation and create supply for the segment, which have huge demand for it. In addition, with the coming of GST regime the prices of houses will further reduce with availability of 'Input tax credit' as the final tax component payable by the end buyer of house is likely to be lesser than the 4.5 percent service tax payable earlier. The BLC component of PMAY (U) enjoys tax exemption under the GST administration as well.

CONCLUSION

In the study "Impact of Investments in the Housing Sector on GDP and Employment of Indian Economy" (2014), conducted by the National Council of Applied Economic Research (NCAER), the construction sector as a whole generates 8.2% of GDP and 11.52% of employment in which the residential sector accounts for 1.24% of the total output of the economy, 6.86% of the total employment and 1% of the Gross Domestic Product (GDP). Given the strong multiplier effect of housing sector on the overall economy, it is all the more important to strengthen the forward and backward linkages to maintain the economic momentum. Investment in the real estate sector is considered to be a barometer of growth for the economy. The bridging of housing gap requires humungous funding of thousand crores and the Government alone cannot meet the figures. As such, partnership between communities, government bodies and private sector is the need of the day as no single organization can meet the multiple needs of a community. Housing policy in India, which earlier focused on construction of houses, has shifted towards creation of an enabling framework, improving access to credit and encouraging multi-stakeholder participation in the housing sector. The recent policy initiatives focus on sustainability and social inclusion, and they recognize the key role of the private sector. Easier lending norms, opening of the ECB route, taxation benefits and greater corporate governance in affordable housing segment, will go along way in addressing the key concerns of real estate sector.

In light of the developments in the real estate sector and the efforts that have gone into creating a suitable landscape for the sector to flourish, it is for the market to pick its pace and opportune the moment to make the most out it. However, a silos approach in adaptation of these interventions may fall short of the desirable outcome and it is for the State Government and the stakeholders to have a collective vision in leveraging the potential benefits extended by the Centre. Given the complex nature of affordable housing conundrum, a multi-pronged approach will go a long way in breaking the incongruity of the issues in hand sustainably. Good quality urban panorama contributes to investment, strong economic performance and wealth creation, as it provides predictability and order in urban development from a wide range of perspectives, including spatial, societal, economic and environmental. Increase in the built-up stock and related infrastructures further leverages municipal finances and gives more autonomy to people-centric planning. The core of all these approach lies in creating a strong, sustainable and vibrant urban space where every household has a well-sheltered existence. With active participation of all stakeholders, the sector will definitely ace its aim of Housing for All.

AFFORDABLE HOUSING FOR ALL IN RURAL AREAS - GOVERNMENT INITIATIVES

VISHV RATAN BANSAL* AND KANIKA BANSAL**

Abstract

Food, clothes and shelter i.e. House, in that order, are the three most important basic needs of any human being. Out of these, providing Housing for all is one of the major challenges for any Government.

With almost two third of its population living in rural areas, Rural housing has been one of the concern areas of the Government since Independence. Many schemes have been announced by the Government from time to time for Rural Housing but the issue gained moment in real sense only after implementation of "Indira Awaas Yojna" in the year 1985. The major target group of the scheme was SCs/STs population falling under BPL and freed bonded labourers. However, certain deficiencies were noticed over the period in the implementation of the scheme and to overcome this, the scheme was re-structured and re-christened as "Pradhan Mantri Awaas Yojna – Gramin" in the year 2016. This paper is an attempt to understand particularly these two schemes and highlight their significance and shortcomings.

INTRODUCTION

Housing is the most important basic need, after food and clothes, for any human being.Owning a house provides certain degree of economic and social security to an individual or the family besides contributing to the upward social mobility with salutary impact on health and educational mobility. In Indian context, the shortfall in housing units is estimated to be around 66.0 million units. However, India being predominantly rural country- census 2011 records that out of 121 crore Indians, 83.3 crore i.e. 68.84% live in rural areas- the shortage of housing units is more acute in rural areas. Though various studies give varied figures of the shortage of housing in rural areas, the working group on rural housing for the 11th Five Year Plan, constituted by Ministry of Rural Development, Govt. of India, estimates this shortage of rural housing to 47.43 million housing units, with 90% of them required for BPL families. This makes the requirement of affordable housing in rural areas that more relevant in Indian context. Govt. of India, on its part, has been announcing various schemes from time to time, for the fulfilment of this gap.

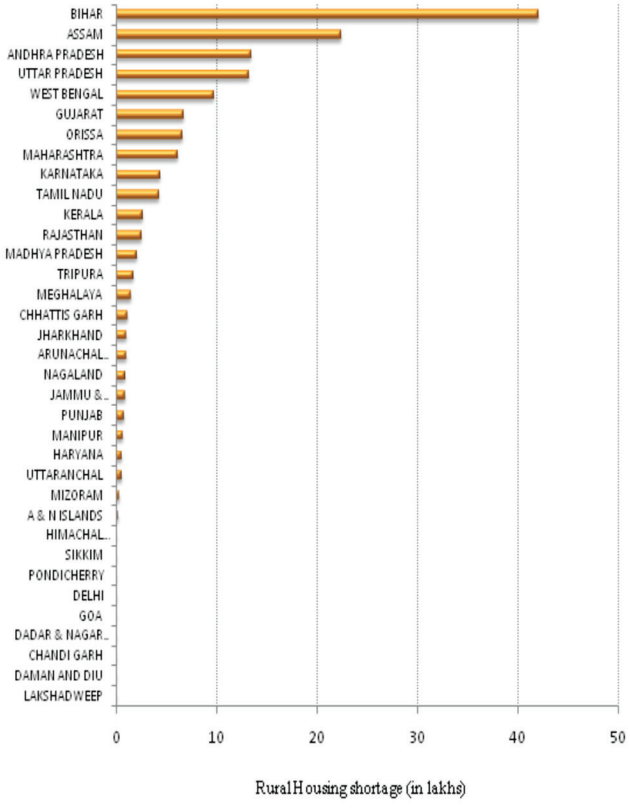

Fig. 1: Rural Housing Shortage (in Lakh)

**Superintending Engineer, North Muncipal Corporation of Delhi, New Delhi*
*** Assistant Professor, Ramaiah Institute of Technology, Bengaluru*

DEFINITIONS

Rural Area

In India, various public and private institutions have been propagating different definitions of rural areas, also known as 'countryside' or 'village', -- but most are lopsided and ignore one or the other important criteria. According to the Planning Commission of India, a town with a maximum population of 15,000 is considered rural in nature.

The National Sample Survey Organisation defines 'rural' as follows:

- An area with a population density of up to 400 per square kilometre,
- Villages with clear surveyed boundaries but no municipal board,
- A minimum of 75% of male working population involved in agriculture and allied activities.

The Census of India 2011 defines urban India but rural India is left for guesswork.

Affordable Housing

Though different countries have different definitions for affordable housing, but it is largely the same.According to a universally accepted definition, affordable units are those which could be afforded by a country's population that earns less than that country's average household income. In other words, houses that the low-income households and economically weaker sections (EWS) can afford are termed affordable housing. However, this definition changes according to the context.

However, the Ministry of Housing and Urban Poverty Alleviation defines affordable housing on the basis of size, price, affordability and income:

- For the EWS, for instance, an affordable house would mean a unit measuring between 300 and 500 sqft, prices below Rs 5 lakh for which a household has to pay Rs 4,000-5,000 in EMI (equated monthly instalment). The income ratios, in this case, should be of 2:3.
- For low-income groups or LIG, an affordable house would mean a unit measuring between 500 and 600 sqft, priced between Rs 7 lakh and Rs 12 lakh for which a household has to pay Rs 5,000-10,000 in EMI. The income ratios, in this case, should be of 3:4.
- For mid-income groups, an affordable house would mean a unit measuring between 600 and 1,200 sqft, priced between Rs 12 lakh and Rs 50 lakh for which a household has to pay Rs 10,000-30,000 in EMI. The income ratios, in this case, should be of 4:5.

Affordable housing becomes a key issue especially in developing nations where a majority of the population belongs to middle or Low income group.

GOVT. OF INDIA INITIATIVES

The Government of India has been taking all necessary steps to meet the shortage of rural housing for quite some time. The earliest known initiative was for rehabilitation of refugees immediately after the partition of the country. After that there were other initiatives in the area of rural housing which are detailed below: -

- In 1957, as part of Community Development Movement, a Village Housing Programme (VHP) was introduced providing loans to individuals and Co-operatives, of upto Rs. 5,000/- per unit. Only 67,000 houses could be built in this scheme till the end of 5th five year plan.
- Another scheme, called House Site-cum-Construction Assistance Scheme (HSCAS), was introduced in the 4th Five-year plan but was subsequently transferred to the state sector in the year 1974-75.

- In the 1980s, Government of India launched wage employment programmes in rural India in the shape of National Rural Employment Programme and Rural Landless Employment Guarantee Programme with specific focus on construction of houses under these programmes for SC/ST and freed bonded labourers.

Indira Awaas Yojna (IAY) : Rural housing initiatives in its true sense and vigour in India began with the Indira Awaas Yojana (IAY) which was launched as a sub-scheme of RLEGP in June 1985, with earmarking of funds for the construction of houses for SC/STs and freed bonded labourers. In April 1989, when Jawahar Rozgar Yojana (JRY) was launched, Indira Awaas Yojna was made a sub-scheme of it and 6% of the funds of JRY allocated to housing for SC/STs and freed bonded labourers. In 1993-94, the coverage of the scheme was extended to non-SC/ST families also and for this, additional 4% funds were provided under Indira AwaasYojna, increasing the total allocation under the scheme to 10%.

However, w.e.f. 1996, Indira Awaas Yojan awas delinked from JRY and made an independent scheme, aimed at addressing the housing needs of the Below Poverty Line (BPL) households.

Indira Awaas Yojana has been one of the biggest and most comprehensive rural housing programme ever taken up in the country. It has been the flagship programme of the Ministry of Rural development as part of larger strategy of rural poverty eradication and to provide the dignity of an address to the poor households to enable them to access different rural development programmes. Under the scheme, the beneficiary, with the assistance from the Government, construct their dwelling unit on their own using their own design and technology.

Salient Features of the Scheme

- Target Group: The initial target group of the scheme was the members of scheduled castes, scheduled tribes and freed bonded labourers living BPL. In 1993-94, its scope was extended to cover non-scheduled castes and tribes identified by the community through gram sabhas following criteria suggested for such identification. Later on, scheme has also been extended to families of servicemen of the armed and paramilitary forces killed in action. Around 3% of the houses are reserved for the disabled persons living BPL.

- Funding Pattern: The cost of the scheme, except the component for the provision of house sites, would be shared between Government of India and the State Governments in the ratio of 75:25. In case of North –Eastern states, the ratio is 90:10. The cost of providing house sites would be shared 50:50 between the Government of India and the State Government whereas in case of Union Territories, Government of India will provide full cost.

- Allocation and Earmarking of Funds: At the national level, 60% of funds would be earmarked for SC/STs with proportion between SCs and STs to be decided from time to time by the Ministry of Rural Development and reflected in the targets. 15% of the funds are set apart for beneficiaries amongst the minorities and 5% of the total funds are kept as reserve funds for emergency situation like natural calamity or riot etc.. This fund would be retained at Central level as reserve fund and can move from state to state. The states should ensure that atleast 3% beneficiaries from the above categories are from persons with disabilities.

Upto 4% of the funds released can be utilized towards the administrative expanses i.e. expenditure done on administering the scheme. Of this, upto 0.5% can be retained at the State level and the balance should be distributed to the district level.

Funding under the IAY is provided by the centre and State in the ratio of 75:25. The present per unit assistance by the centre is Rs. 70,000/- in plain areas and Rs. 75,000/- in hilly and difficult areas, which was increased in 2013 from the earlier respective assistance of Rs. 25,000/- and Rs. 27,500/-.

Subsidy under the scheme is sanctioned either in the name of the female member of the household or jointly in the name of both spouse. Payment shall be made into the bank/post office account of the beneficiaries except in cases where prior permission to pay in cash has been taken from the Empowered Committee

Allocation of funds under the scheme to States and UTs used to be based on the criteria of housing shortage and poverty ratio, with a weightage of 75% given to the scarcity of housing and 25% to poverty ratio, with the beneficiaries being identified by Gram Sabha. Now, this allocation is made on the basis of houseless people from among the BPL population for each category i.e. SCs/STs, minorities and others based on the Socio-Economic Caste Census (SECC) undertaken during the Census 2011.

The districts shall follow the same criteria for re-allocation of the funds to blocks.

Funds are routed through District Rural Development Agencies (DRDA). States are authorized to make disbursement of the funds to beneficiaries on a staggered basis depending upon the progress of work, in two or more installments. The programme mandates completion of the dwelling unit in not more than two years' from date of sanction of first installment but extension of upto one year may be granted to the beneficiaries to complete his dwelling unit and such cases should be regularly monitored.

Components of the scheme: Under Indira Awaas Yojna, financial and technical assistance is provided to the members of the target group for providing:

- Construction of new houses
- Upgradation of dilapidated orkutcha houses
- house sites to landless poor
- Special projects for utilizing the reserve funds

Under the programme, the beneficiary is expected to construct a pucca house with a toilet and a smokeless challah. The minimum built up area of such house shall be atleast 20 sq.m. with an expected life-span of 30 years. If States provide additional assistance, minimum built-up area can be enhanced by the state. However, in order to prevent people falling into debt, the states can fix up maximum area at their level. The State Governments can adopt any building technology which helps in achieving these standards and is more suited to local conditions. However, if any new technology is to be adopted, prior approval is required to be taken from the Empowered Committee or any agency approved by the Empowered Committee.

The unit cost of an IAY house in plain areas, in hill states and in difficult areas is given in schedule reproduced in Table 1.

Table 1: Schedule for Unit Cost

S. No.	Item	Unit cost (Centre's share of subsidy)	Central and State Share
1.	Construction of new house (i) Plain areas (ii) Hilly States and difficult areas & IAP districts	Rs. 70, 000/- Rs. 75,000/-	90:10 for NE States and Sikkim 100:00 for UTs 75:25 in other cases
2.	Upgradation of dilapidated or kutcha house	Rs. 15,000/-	As in (1) above

3.	House sites for eligible landless	Rs. 20,000 /-	100:00 for UTs 50:50 in other cases
4.	Administrative Expense	4% of funds released	As in (1) above

The scheme also provides for assistance to landless poor for the purpose of providing house sites so that they can build their houses. State Governments are required to notify the entitlement for house sites and thus these may vary from state to state.

- Agency for implementation: At the district level, the implementation should be through Zilla Parishad or its equivalent in States where there is no Zilla Parishad. At the local level, the village Panchayat or its equivalent where the State has no Village Panchayat, would implement the programme.
- Empowered Committee: The programme also has the provision of Empowered Committee under the chairmanship of Secretary (Rural Dev.) with administrators connected with the implementation of the programmes as well as the experts in the field of affordable housing as its member, to oversee the overall implementation of the programme.. The main functions of the Committee include approving State's criteria for determination of difficult areas; decide on the targets and re-allocation of funds and approval of new construction technologies and periodic review of the programme etc.
- Recent developments in IAY: Since August 2005, the scheme has been brought under the ambitious Bharat Nirman Programme and set the target of constructing 60 lakh houses during the period 2005-09. The scheme has subsequently been re-structured as Pradhan Mantri Awaas Yojna- Gramin in 2016.
- Achievements: Since inception, 351 lakh houses were constructed under the scheme, incurring an expenditure of Rs. 1,05,815.80crore.

Strength and Weaknesses of Indira Awaas Yojna

Strengths of IAY:

Evaluation studies and feedback indicate the following positive features of IAY.

- The basic benefit of shelter has been provided to significant proportions of socially and economically vulnerable sections.
- It provides social security for the woman as the subsidiary is sanctioned in the name of woman members of the household.
- Fairly good satisfaction levels with constructed houses amongst the beneficiaries
- The occupancy rate of constructed IAY houses is high.
- There has beenadequate coverage of SC and ST beneficiaries.

There have been other benefits of the scheme as follows:

a. Construction activity is estimated to have generated considerable employment besides providing scope for skilled beneficiaries like the mason, carpenters, etc.

b. Beneficiaries have developed a sense of opportunity especially for expanding self-employment activities. Besides as the basic need of housing has been fulfilled, the beneficiaries are more equipped to focus on earning, etc.

c. A cleaner environment has been provided by IAY houses

Shortcomings in IAY

- Improper assessment of housing shortage. Only 15 lakh houses could be created/ renovated annually through IAY which is much less than the expected
- Beneficiaries should be selected without the influence of any person.
- Even the recently enhanced unit cost was not sufficient for constructing a basic minimum house, resulting in beneficiaries availing loans and falling into debt-trap. Or else, it resulted in incomplete or poor quality houses.
- Need for developing a more efficient network of delivering low-cost, appropriate housing technologies.
- Housing scheme not linked with other infrastructure related development schemes for roads, drains, drinking water etc.

PRADHAN MANTRI AWAAS YOJNA-GRAMIN

Although IAY addressed the housing needs in the rural areas to a large extent, certain gaps were identified during the concurrent evaluations and the performance audit by Comptroller and Auditor General (CAG) of India in 2014. These gaps, i.e. non-assessment of housing shortage, lack of transparency in selection of beneficiaries, low quality of the houses and lack of technical supervision, lack of convergence, loans availed by beneficiaries and weak mechanism for monitoring were limiting the impact and outcome of the programme.

To address these gaps in the rural housing program and in view of Government's commitment to providing "Housing for All'' by the scheme 2022, the IAY has been re-structured into Pradhan Mantri Awaas Yojana – Gramin (PMAY-G), w.e.f. 1st April 2016.The modifications carried out in Indira Awaas Yojna (IAY) are enumerated iunder the 'Key Features' below and all other provisions of IAY remain same.

PMAY-G aims to provide a pucca house with basic amenities to all houseless households and households living in kutcha or dilapidated house in rural areas by 2022. To achieve the objective of "housing for all", the target number of houses to be constructed by the year 2021-22, is 2.95 crore. The immediate the objective is to cover 1.00 crore household living in kutcha house/dilapidated house in three years from 2016-17 to 2018- 19 at an estimated cost of Rs. 1,30,075 crore and enable construction of quality houses by the beneficiaries using local materials, designs and trained masons. Adoption of habitat approach through convergence is also proposed.

Key Features of PMAY-G:

Pradhan Mantri Awaas Yojna - Gramin covers the rural area of the entire country, except the UT area of Delhi and Chandigarh,The minimum size of the house has been increased to 25 sq.mt (from20sq.mt. in IAY) with a hygienic cooking space. The unit assistance has been enhanced from Rs. 70,000/- to Rs. 1.20 lakh in plain and from Rs. 75,000/- to Rs 1.30 lakh in hilly states, difficult areas and IAP district. The beneficiary is entitled to 90/95 person day of unskilled labour wages from MGNREGA for construction of house, over and above the unit assistance. Provision has been made for the assistance (Rs. 12,000/-) for construction of toilet though convergence with SBM-G, MGNREGS or any other dedicated source of funding. Convergence with other Government programmes for provision of various basic amenities i.e. piped drinking water, electricity, LPG gas connection etc. are also to be attempted.

A willing beneficiary will be facilitated to avail loan of up to Rs.70,000/- form financial Institutions which would be monitored through the SLBC and DLBC.

The cost of unit assistance is to be shared between Central and State Government in the ratio 60:40 in plain areas and 90:10 for North Eastern and the three Himalayan States i.e. Jammu & Kashmir,

Himachal Pradesh and Uttarakhand. However, in Union Territories, 100% share is borne by Centre. From the annual budgetary grant for PMAY-G, 95% of funds are to be released to States/UTs for the construction of new house under PMAY-G. This would also include 4% allocation towards administrative expenses. 5% of the budgetary grant is to be retained at the central level as reserve found for special projects. The annual allocation to the states is to be based on the annual action plan (AAP) approved by the Empowered Committee and the fund to States /UTs is to be released in two equal instalments.

The annual allocation to the States/UTs shall be based on the annual action plan of the States/UTs for PMAY-G, approved by Empowered Committee. This action plan shall include a plan for convergence with other Government programmes. The mechanism for convergence in PMAY-G is also to be strengthened through a system to system real-time transfer of information between the programmes that are to converge with PMAY-G.

One of the most important features of PMAY-G is the selection of beneficiary. To ensure that assistance is targeted at those who are genuinely deprived and that the selection is objective and verifiable, PMAY-G, instead of selecting the beneficiary from among the BPL households, selects beneficiary using housing deprivation parameters in the Socio Economic and Caste Census (SECC), 2011 which is to be verified by the Gram Sabhas. The permanent wait list so generated also ensures that the states have the ready list of the household to be covered under the scheme in the coming years (through annual select lists) leading to better planning of implementation. To address grievances in beneficiary selection, an appellate process has also been put in place.

In order to ensure better quality of construction, setting up of a Nation Technical Support Agency (NTSA) at the national level is envisaged. One of the major constraints in quality house construction is the lack of the sufficient number of skilled masons. To address this, a pan-India training and certification programme of masons has been launched in the States/UTs. This will, in addition, ensure career progression for rural masons. For timely construction/completion and to ensure good quality of house construction, it has also been envisaged to tag a PMAY-G beneficiary with a field level Government functionary and a rural mason.

Under PMAY-G, the beneficiary, in addition to financial assistance, shall also be offered technical assistance. The beneficiaries are to be offered a bouquet of house design typologies inclusive of disaster resilience features which are suitable to their local geo-climatic conditions. These designs are developed through an elaborate public consultative process. This exercise will ensure that the beneficiary does not over-construct in the initial stages of house building which often results in the incomplete house or the beneficiary being forced to borrow money to complete the house.

Programme implementation and monitoring under PMAY-G is to be carried out through an end to end e-Governance model- using Awaas Soft and Awaas App. While Awaas Soft is a work – flow enabled, web-based electronic service delivery platform through which all critical function of PMAY-G, right from identification of beneficiary to providing construction linked assistance (through PFMS), will be carried out; AwaasApp- a mobile application, is to be used to monitor real time, evidence based progress of house construction through date and time stamped and geo-referenced photographs of the house. The two IT application help identify the slip-ups in the achievement of targets during the course of implementation of the programme. All payments to beneficiary are to be made electronically to beneficiary's bank/post office accounts that are linked to aadhar and registered in Awaas Soft MIS.

The programme implementation is to be monitored not only electronically, but also through community participation (social audit), member of parliament (DISHA Committee), Central and State Government officials, National Level Monitors etc.

CONCLUSION

Even though the successive Governments, both at Centre and the States, have been doing their bit and bringing in schemes to provide houses to houseless poor living in the rural areas since independence, still much needs to be done for fulfilling the 100% success, primarily due to mis-match between the scale of the problem and the pace of the efforts to tackle the same. Indira Awaas Yojna was first serious attempt in this direction but that has also not been able to achieve the desired results. In Pradhan Mantri Awaas Yojna- Gramin, attempt has been made to address the shortcomings noticed in the implementation of Indira Awaas Yojna. It is hoped that the targets set under PMAY-G will be fully achieved and India will be able to overcome the problem of houselessness in the rural areas.

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RENTAL HOUSING: AN INCLUSIVE APPROACH TO AFFORDABLE HOUSING

Usha Batra*

Abstract

Affordable housing by 2022 is one of the topmost priorities of present Government of India, particularly for economically weaker sections and low income group of society. Ownership housing has been the singular aim of housing policies in India without any emphasis on rental housing. In fact, the Rent Control Acts, designed to safeguard the interests of tenants, resulted in the choking of supply of rental housing due to overprotective regimes of rent-setting and eviction procedures.

The paper emphasizes the need for rental housing, design and location of rental housing with clear indication as to who should own it including the need of rental housing policy, the highlights of National rental housing policy 2015 and thereafter steps taken by Government of India for promoting rental housing. Prevalent Rental housing schemes are also discussed emphasizing the successful schemes launched in different cities of India. A case study of Rajkot has been studied which indicates the extent and type of rental housing, the clients and suppliers of the same giving reasons of the prevalent details. At the end, an attempt has been made to suggest rental housing schemes in partial fulfillment of the main purpose of achieving affordable housing by 2022

INTRODUCTION

India is undergoing through a process of rapid urbanization as clear from the fact that whereas the total population of India has grown 3.4 times during the period 1951 to 2011, the urban population has grown 6 times during the same period from 62.4 million to 377.1 million. Therefore, India is going to be a country of urban population in near future. Realizing the need of urbanization, government is also giving emphasis on creation of infrastructure in various cities and towns and also taking steps to provide "Housing for All by 2022".

Every city has 30-40% of floating population who cannot afford to buy a house. Considering employment generation in cities, such population is likely to increase.

It is also estimated that 70% of new employment will be generated in cities by 2030. One of the solutions to tackle the demand for such floating population is rental housing. The growth of service sector, rising aspirations of young population, frequent change of job and dynamic growth potential with flexible career opportunities will also create greater demand for rental housing which is likely to grow over the years especially in urban areas which are a hub of new and global opportunities. Rental housing has the potential to minimize the capital requirement on the part of government as well as to promote inclusive growth.

Considering government priority for "Housing for All by 2022", present time is appropriate to supplement ownership housing by a strong, vibrant and sustainable inclusion of rental housing market with different models to address diverse housing needs for various segments of the population. This is also an additional option for housing to all sections of the society, particularly to the EWS/LIG, migrants and vulnerable groups who may not be able to afford a home even with various incentives for ownership housing. Rental

*Additional Director General (Arch), CPWD, New Delhi

housing is also desirablefor a number of reasons like prevention of permanent migration from rural areas, affordability and checking the slum problem in urban areas.

NEED OF RENTAL HOUSING

Rental Housing has been adopted as a part of affordable housing all over the world. Advantage is that the occupants not able to pay the cost immediately can pay the same over long period as decided by the authorities. Disadvantage is that such a scheme may attract others also to migrate from rural areas to urban areas temporarily that may prefer to settle permanently in the urban areas. The rental scheme is therefore recommended only for temporary migrants purely on rental basis. Such migrants may be construction workers, workers engaged in the commercial establishments and even employees working in regular establishments.

Government of India has already announced "Housing for All – Urban" under which 20 million houses are going to be constructed. These 20 million houses are for EWS category and LIG category. In general it can be assumed that the plinth area of each unit of EWS will be around 30 sqm and of LIG as 60 sqm. In case, it is assumed that 17 million houses will be of EWS and 3 million of LIG then total area to be constructed without even development works will be around 690 million sqm. If the period of construction is 5 years, 138 million sqm constructed area will be carried out annually. If rate of construction is assumed as Rs.20000 per sqm, cost of construction will be around Rs 27,60,000 millions i.e. Rs 2,76,000 crores every year. If the component of contractor's profit and overheads is considered 15% and of labour as 25%, labour cost will be around 58650 crore every year. If the average wage of a worker is Rs.10000 per month or Rs.1,20,000 per annum, number of workers required will be around 48,87,500 i.e. about 48 lakh unskilled workers and 1 lakh skilled workers. For such a migratory force as normally all the workers are migratory workers in the construction sector, shelter is required else possibility of slums in the urban areas getting developed cannot be ruled out that too for such a large workforce. Therefore, rental housing needs to be constructed for such workforce also.

OWNING THE RENTAL HOUSING

- Builders and Contractors:-Builders and contractors are constructing housing and commercial establishments in urban areas and few companies have the construction activities in many big cities. They require engaging construction workers and are supposed to provide accommodation to the workers but due to non-availability of accommodation with them, leave the workers to get settle somewhere or get them settled on the government land and then these get converted into slums. Therefore, big companies should be allowed to construct rental housing for their workers.
- Business Owners :- Business owners can also develop Rental housing for business purposes. The builders who have the financial resources can build rental housing for different category of occupants like workers, employees of commercial establishments, working women, and regular employees. The contractors and builders who cannot own such housing can hire such accommodation for their workers.
- Government owned Rental Housing:- Government owned rental housing may be the outcome of extra FSI/FAR provided by the government to the builders and in lieu of which rental accommodation may be constructed. Such housing may be given to existing slum dwellers already residing in urban areas as a slum rehabilitation programme. To construct such rental housing, governments will have to revise their Rent Acts and may be Master Plans so that they become attractive. This will also help in permanent migration of construction workers and other employees from villages/towns to cities at site and also non mushrooming of slums in cities.

- It is also to be considered that on one hand there is huge housing shortage (urban) and on the other hand there are massive stocks of vacant houses. As per census 2011 data, 11.09 million houses are vacant in urban areasand at least 27% urban people live in rental accommodation.
- Employer provided Rental Housing :-In this case the office and housing are in the same campus. This is to facilitate the employee to search for a house nearby office suiting to his requirement and affordability. This will increase the efficiency in the office / industry and satisfaction of the employee. This approach is successful even in cases where the workplace is far away from the main city. Even in Government housing in unpopular areas, this concept makes them popular due to workplace next to housing.

DESIGN OF RENTAL HOUSING

Design of rental housing cannot be uniform as it needs to be designed as per the requirements of the occupants. The following type of rental housing is suggested;

- Dormitory housing for unmarried construction and other workers
- Hostel accommodation for working women and men
- Individual studio flats for married employees
- Individual one bedroom/two bedrooms flats for working employees

LOCATION OF RENTAL HOUSING

Rental housing is directly connected with livelihoods, education and opportunity, even more so than ownership housing. Households may choose to own a home away from the city for investment and future use,but will only rent where they are close to workand education. Government of Odisha has taken a step ahead in this direction through tapping the resource of Construction Workers Welfare Board (CWWB). Through a joint initiative of Government of Odisha (H&UD dept) and CWWB, it has been decided to provide shelter to this deprived group in proximity to ongoing and perspective construction areas through dormitory system for bachelors and single unit for workers with family of permanent structure with vertical expansion having community level basic facilities like sanitation, drinking water, electricity, connectivity, common kitchen and dining space, open space for socialization etc. Fig. 1 (a&b) As per "Times of India Dt. 30.04.2017", Bhubaneswar, construction labours who are staying in deprived conditions without access to shelter and basic amenities in the city, state government will build three rental housing projects for them with total 400 beds who can stay by paying considerably low amount of rent.

(a) Single unit at Odisha

(b) Dormitory at OdishaToilet

Fig. 1: Typical Design of Rental Housing

NEED FOR RENTAL HOUSING POLICY

It has generally been the responsibility of States to intervene towards meeting the housing requirements of the vulnerable sections of society and to create an enabling environment for provision of shelter to all on a sustainable basis.

The National Housing Policies have always been aimed at encouraging at ownership housing rather than rental housing. House ownership is unlikely to solve the housing shortage in urban India keeping in view that majority of the urban housing shortage pertains to EWS and LIG categories who cannot afford to own a house due to low disposable income, irregular income, ever increasing real estate prices etc. Rental housing can provide an opportunity to the tenants as well as enable a steady source of income to the owners that converts urban land into an investment.

As per Census 2011, over 27% of urban residents of the country are living on rent and most of them are informal in nature. The NSSO report has highlighted that 25% of the hired dwelling units are informal and only 5% are formal.

A number of migrants come for varying durations of stay whether in search of employment or education. Some urban residents may already have a house or a piece of land in their respective place of domicile and may not need or be interested in ownership housing in urban areas and would look for affordable rental accommodation. Hence, addressing affordability issues of housing through promoting rental housing is necessary for inclusive urban development. This will reduce the demand of affordable housing and simultaneously reduce the problem of disposing off the house while shifting back.

Rental housing may also contribute towards preventing future growth of slums by providing affordable housing option to poor migrants. Rental housing provides options closer to the place of work and has the potential to improve their productivity.

National Urban Rental Housing Policy (NURHP), 2015 was drafted with a vision to create a vibrant, sustainable and inclusive rental housing market in India with the objectives as given in the following;

- To create adequate rental housing stock by promoting Social Rental Housing
- To promote Shelter facilities for the most vulnerable groups within the homeless population such as single women and their dependent minor children, aged, infirm, disabled, mentally challenged etc.
- To promote Social Rental Housing for urban poor (EWS and LIG as defined by Government of India from time to time) as a viable alternative housing option.
- To promote Need Based Rental Housing (short/mid/long term basis) for specific target groups such as migrant labour, single women, single men, students (any other target group as defined by the State) who have the ability to pay only up to a certain amount of monthly rent
- To promote Market Driven Rental Housing (MDRH may or may not be eligible for direct benefits from government):
- To promote Private Rental Housing as an interim measure towards aspirational home buyers.
- To enable Institutional Rental Housing (Hostels/PGs/dormitories) for working class with special focus on low earning employees working with Government/PSUs/Corporate houses/Industries/NGOs etc (any other category as defined by the State Government from time to time).

According to a report by The Economic Times, March 2017, for promoting rental housing, Government has declared that a new rental housing policy will be specifically aimed at the families below poverty line. The scheme is expected to be implemented soon. The Rs 2,700 crore welfare scheme will be implemented in 100 smart cities to give rent vouchers to the urban poor with the aim helping the poor migrant population. Under the scheme, urban local bodies would distribute rent vouchers to the identified families. The tenant would give these vouchers to the landowner, who in turn would be able to redeem them at any citizen service bureau. Such scheme is prevalent in USA. The implementation of the scheme is expected to

cost the exchequer Rs 2,713 crore every year. The properties seized under the Benami Properties Act will also provide as housing option in this scheme. The policy will outline measures to encourage investments in social rental housing with government support and market driven rental housing without government support.

RENTAL HOUSING SCHEMES

- Rental Housing for the Prospective Migrants/ Homeless: These can be given on rent up to a certain time on a short to long term basis, thereafter occupants are expected to move to their own houses except for homeless, destitute, aged people and people with special needs.

- Rent to Own Scheme: Ultimate goal is to favour homeownership, to benefit the poor who can't afford to buy a house. Initial allotment of the unit is done on lease basis for a fixed number of years. Buyer deposits the monthly rent/ EMI in bank account.On 100% payment, property papers are handed over to the buyer by de-hypothecation. Implemented by Chandigarh Housing Board, Chandigarh in 2006 such scheme for slum free city was a great success and could be implemented seamlessly because of support of local leaders and political will of Chandigarh Housing Board. This model can be repeated in many other cities with suitable modifications that suit different types of cities for eradication of slums.

- Converting Slums on ULB Land to Rental Housing: Slums occupying Urban Local Bodies (ULB) land can be converted to rental housing. ULB can give a "no eviction guarantee" to the household for a fixed period say 10 years or more, and gain rent revenue from the household in exchange for the utilization of the ULB land. Such scheme in Ahmadabad hasgiven good revenue for the ULB.This model could generate between 15 and 25 % of the ULBs' revenue.

- Allowing extra FSI/TDR: The MMRDA rental housing scheme is based on the incentivization of housing development through premium Floor Space Index (FSI) or Transferable Development Rights (TDR) for undertaking the development of rental housing stock by land owners/ private developers. Higher FSI/TDR is allowed to be used by the developers towards cross-subsidization of rental houses with other developments on the plots. Three models were considered by MMRDA. The proposals with costing and recovery details are given in the following;

Model 1: Higher FSI up to 4.00 with TDR application on private land: Of the total 4.00 FSI granted 3.00 FSI will be used for the rental housing however TDR will be applicable for the non utilized balance FSI. For example;

i. Area of land in sq.m. (A)= 10,000

ii. FSI for Rental Housing (B)= 3.0 FSI

iii. Built-up Area of Rental Housing in sq.m. (AxB=C) = 30,000(1667 units)

iv. Total built-up area of Rental Housing in sq.m. including balwadi, amenity,

staircase, passage etc.(1.3xC=D)= 39,000

Costing

i. Rate of Construction of Rental Housing (E) = Rs.10,000/sq.m.

ii. Cost of construction (DxE=F) = Rs.39,00,00,000

iii. Rate of land (Assumed Rs 930/Sq.ft.) (G) = Rs.10,000/sq.m.

iv. Cost of land (AxG=H)= Rs. 10,00,00,000

v. Cost to developer (F+H=I)= Rs. 49,00,00,000

Recovery

i. Total TDR ((Land TDR + Construction TDR) A+1.33D=J) = 61870 sq.m

ii. Market Rate of TDR (K) =Rs.10000/sq.m.

iii. Value of TDR (JxK=L)= Rs.61,87,00,000

iv. Surplus (L-I=M)= Rs.12,87,00,000

Model 2 : Higher FSI up to 4.00 with no TDR application on Private Land: Of the total 4.00 FSI granted, only 1.00 will be utilized for rental housing; however TDR transfer benefits will not be available to the developer.

i. Area of land in sq.m. (A) = 10,000

ii. FSI for Rental Housing (Minimum 25% land) (B) = 1.0

iii. Built-up Area of Rental Housing in sq.m. (AxB) = 10000 (555 Units)

iv. Total built-up area of Rental Housing in sq.m. including balwadi, amenity, staircase, passage etc. (1.3xAxB=C) = 13,000

v. FSI for Private Housing (Maximum 75% land) (D) = 3.0

vi. Total built-up area of Private Housing in sq.m. including,amenity, staircase, passage etc. (1.3xAxD=E) = 39,000

Costing

i. Rate of construction (F) =Rs.10,000/sq.m.

ii. Cost of construction of Rental Housing (CxF=G) = Rs.13,00,00,000

iii. Cost of construction of Private Housing (ExF=H) = Rs.39,00,00,000

iv. Rate of land (Assumed Rs 150/Sq.ft.) (I) = Rs.15,00/sq.m.

v. Cost of land (AxI=J) =Rs. 15,00,00,00

vi. Cost to developer (G+H+J=K) = Rs. 53,50,00,000

Recovery

i. Rate of sale of Private Housing assumed Rs 1394/sq.ft (L) = Rs.15000/sq.m.

ii. Sale Recovery (ExL=M) = Rs.58,50,00,000

iii. Surplus (M-K) =Rs (50,000,000)

Model 3 : Higher FSI up to 4.00 on MMRDA (Government land): Of the total 4.00 FSI granted, 3.00 will be utilized for rental housing while the remaining 1.00 will be utilized for commercial development.

i. Area of land in sq.m. (A) = 10,000

ii. FSI for Rental Housing (B) = 3.0

iii. Built-up Area of Rental Housing in sq.m. (AxB) = 30,000 (1667 Units)

iv. Total built-up area of Rental Housing in sq.m. including balwadi, amenity, staircase, passage etc. (1.3xAxB=C)= 39,000

v. FSI for Commercial (D)= 1.0 FSI

vi. Total built-up area of Commercial including, amenity, staircase, passage etc. (1.3xAxD=E) = 13,000

Costing

i. Cost of land = Government land

ii. Rate of Construction (F) = Rs.10,000/sq.m.

iii. Cost of construction of Rental Housing (CxF=G) = Rs.39,00,00,000

iv. Cost of construction of Commercial (ExF=H) = Rs.13,00,00,000

v. Cost to developer (G+H=I)=Rs. 52,00,00,000

Recovery

i. Rate of sale of Commercial Area (Assume Rs.4648/sq.ft) (J) = Rs.50,000/sq.m.

ii. Sale Recovery (ExJ=K) = Rs.65,00,00,000

iii. Surplus (K-I) = Rs.13,00,00,000

CASE STUDY OF RAJKOT

Rajkot is the fourth largest city in the state of Gujarat with a population of a little more than

10 lakh as per Census 2001 with a strong rate of industrialization and resultant urbanization. Rajkot has about 3,000 small and medium scale industrial units within the city. Rajkot has nearly 20 per cent land use under industrial activities. In the city, slum population has increased from14.39% in 1971 to 20.2% in 2001.

Types of Rental Housing

Single Room Tenements : Single rooms (10sq.m.) Fig.2 are built in a row to be given out either to single male migrants or to migrant families, without windows or ventilation with slab or a corner dedicated to cooking. All other services are common. The owner and tenant may open out into the same compound, thus sharing common activity space (for cooking, cuttingvegetables, washing, etc.) or sometimes the tenants are in row-houses opening out on theroad, without a common space.

Single Room Tenement

Part of house given on Rent

Fig. 2: Rental Housing

Part of House given on Rent: Many owners tend to give part of their house on rent. In some cases the room that is rented, may have a separate entry. In such cases, the tenants are families rather than single male migrants, as it is perceived to be a saferoption. Both families (owner and tenant) share washing space and bathroom.

Full House given on Rent: Many households whose affordability increase move out ofthe slum or informal settlements towards localities of greater security of housing tenure.In such cases, they rent out their houses in the slums, informal settlements. In most cases, the owner of the house stays in another house within thesame locality. However, there are cases where tenants have become owners of theirproperty on account of death of the owner.

Employer provided Rental Housing : This was seen in small number of cases, one case being in Khodiyarnagar where in the owner of a small metal workshop built single room tenements above his workshop to house the workers. In spite of large industrial activities in Rajkot, concept of employer provided housing is missing, giving impetus to large scale informal settlements and rental housing.

Extent of Rental Housing in Informal Settlements

As per the Rajkot Municipal Corporation records there are about 190 slums and informal settlements in Rajkot city, wherethe migrants are most concentrated. The migrant population forms the core demand group forrental housing. In that case it was found that on an average every settlement has about 30 per centrental households.It was observed that the peripheries are open to squatting and the migrants attempt to find a foothold in the peripheries and consolidate their lives in the peripheries. They do not move into the city core unless they have social networks like friends and family.

Security of Rental Tenures

A most encouraging fact revealed through the survey data that nearly 67 per cent households reported that their landlords are flexible in terms of timely payment of rent, as well as the amount of rent paid. At places, 83 per cent tenants reported that they will not be asked to vacate if they cannot pay the rent on time. For many tenants, paying a fixed amount is not possible and they tend to pay their rent in installments as per their capacity. Of the total,about 33 per cent of the tenant households reported insecurity in terms of eviction due to non timely rent payments.

Types of Suppliers

- Rental housing was found to be supplied by households who can afford to build more than they require. Households, who have settled at a location for long, have a steady flow of income.
- In some cases, households who have migrated out of the city and purchased own homesgive out part of the house on rent to earn extra incomes.
- Free land is encroached upon to build not just self-help housing but also rentalhousing.
- Certain communities have natural inclination to act in the informal market through organizing encroachments or capturing of public lands.

Clients for Rental Housing

The migrants are the main users of rental housing such as seasonal migrants and permanent migrants. Seasonal migrants were found to be single male migrants from outsideGujarat state. Permanent migrants were mostly the single male migrants from around Rajkot or within Gujarat, who migrate looking for better employment opportunities. Such migrants eventually become home owners as their affordability increases.

Duration of Stay in Rajkot

More than 50 per cent of owners have settled in the city for more than 30 years. 86 per cent owners have been in Rajkot for more than 15 years and only 27 per cent tenant households have been in the city for more than 30 years. 20 per cent tenants fall in the less than 5 years category, while only about 1 per cent of owner households are in the less than 5 years category.

OUTCOME OF STUDY

Rental housing is a must for short term or long term migrants. Informal rental housing in Rajkot lacks the basis infrastructure and hygiene which can be taken care by formal rental housing. Encroachment of public land and unoccupied government land can be avoided by making use of such land for formal rental housing.

CONCLUSION

Looking at the extent of floating population, rental housing is the most desirable solution to the partial fulfillment of affordable housing. Location is very important as it has direct relation with the purpose of rental housing thereby saving time as well as money and simultaneously reducing burden on transport infrastructure.

Requirements of different type of rental housing i.e. dormitory, hostel, studio apartment or one/ two bedroom flat need to be ascertained to fulfill the main purpose of affordable rental housing. Appropriate use of FSI and TDR needs to be ascertained to avoid extra density and burden on infrastructure. Builders, contractors and government need to share the responsibility to make rental housing a success. Both the schemes i.e. ownership after renting out for few years as well as simply renting out have to go side by side depending upon the requirement and affordability of the individual. Necessary amendments are required to be made in "Rent Control Acts" to popularise rental housing.

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HOUSING FOR ALL IN URBAN INDIA-A MYTH OR REALITY

Jit Kumar Gupta*

Abstract

Providing 'Housing for All', has been accepted by Government of India as the integral part of National Housing Policy and key area of action, placing it high on the development agenda of the nation. Multiple connotations and criticality of housing in human living, economy and human habitat, as provider of identity, security and determinant of quality of life besides promoting economy, minimizing unemployment, leveraging industrialization and rationalizing growth and development of human settlements are of utmost importance. However, considering the complexity, cost and resource intensive nature and ever growing mismatch between demand and supply, particularly in the lower income categories, creating appropriate housing for all housing stressed families/individuals remains the most challenging and formidable national task.

In order to define agenda for action, paper identifies various roadblocks hampering the supply of adequate housing and suggests options to make 'Housing for all', a distinct reality. In search for appropriate solutions, paper explores various options involving; sourcing adequate land at affordable cost; optimization of land resource through rationalized building bye-laws; using state of art planning/architectural solution; using innovative cost-effective and time - effective construction technologies; promoting standardization and pre-fabrication; using local/waste based materials; promoting green habitat; ensuring quality project management; involving private sector and all the stakeholders to achieving the national objective.

INTRODUCTION

Housing remains most vital and critical sector for the individuals, community, society, states and nations because of its complexity and large connotations it has in terms of economy, employment, security and quality of life. It is said to be growth escalator and a sector that contributes directly to the quality of life and productivity. Due to its far reaching implications, international human rights law recognizes everyone's right to an adequate standard of living, including housing. Adequate housing, has also been recognized as part of the right to an adequate standard of living in the 1948 Universal Declaration of Human Rights and 1966 International Covenant on Economic, Social and Cultural Development.

Housing is also known to be an important sector of economy and employment. As per India Habitat III National Report, 2016, 'In India, the construction sector, which includes housing, accounts for 8.2 per cent of its gross domestic product (GDP) and employs approximately 12 per cent of the work force.' In addition, more than 250 industries are said to be directly or indirectly connected with the construction sector and accordingly, growth and development of industry is largely contingent on the growth of construction sector and construction of housing. Considering the multiple connotations, providing housing has emerged major priority for the society and nations, locally and globally.

Housing known for its complexity is, largely dictated by demand and supply. The demand for housing rises in direct proportion to the increase in population, rate of urbanization, rate of migration, income, climate, culture and market conditions.

**Founder Director, College of Architecture, IET Bhaddal (Punjab)*

However, supply is contingent on factors including economic, physical, social and the decisions of individual households, builders, promoters and developers. Matching the demand and supply has been found to be most complex task leading to e gaps merging in terms of over-supply for some sections of populations and under-supply for others, leading to exclusion of large proportion of population from the housing market, invariably resulting in mushrooming of slums and houseless-ness. UN Habitat Report on Right to Adequate Housing states that, 'Despite the central place of the right to adequate housing within the global legal system, well over a billion people are not adequately housed. Millions around the world live in life- or health threatening conditions, in overcrowded slums and informal settlements, or in other conditions which do not uphold their human rights and their dignity'. India Habitat III National Report, 2016 observes that, 17% urban population in India was living in slums in 2011, which means every sixth urbanite was having poor quality of life. In addition, 0.15% population of India (1.77 million) was counted to be homeless - without any kind of shelter, roof and walls.

Considering the role and importance of housing in promoting the individuals and nation's growth and development besides large number of problems existing in the sector, Habitat II Conference — the Istanbul Declaration called for constituting a framework for linking human settlements development to the realization of human rights in general and housing rights in particular. The Habitat Agenda states that,' within the overall context of an enabling approach, Governments should take appropriate action in order to promote, protect and ensure the full and progressive realization of the right to adequate housing.' In order to achieve the objectives enshrined in the international declarations and to provide quality of life to all Indians, Government of India has adopted the agenda, 'Housing for all, by the year 2022' .

EXISTING HOUSING SCENARIO

India Habitat III National Report, 2016 while detailing out the housing scenario in Indian states,' Various policies and programs formulated by the Government of India and implemented by the state-level public housing agencies such as the Housing Boards, Development Authorities, Improvement Trusts, Slum Clearance/Improvement Boards, etc. have had a positive impact in the overall living conditions of the urban poor. The urban housing stock has increased from 52.06 million to 78.48 million (51 per cent increase) in the last decade. Absolute housing shortage in terms of the difference between the number of existing households and existing housing stock in urban areas has significantly reduced from 1.63 million in 2001 (3 percent) to 0.39 million (0.5 per cent) in 2011..... The dilemma is that while the sustained effort of the government to improve the condition of the housing sector is reflected in the above numbers, a further review reveals that the urban housing shortage has increased considerably due to housing congestion and obsolescence factor, of which 96 per cent pertains to the Economically Weaker Sections (EWS) and the Lower Income Groups (LIG)'.

Estimates made by, 'Technical Group' constituted by Ministry of Housing and Urban Affairs has placed urban housing shortage at 24.71 million dwelling units at the end of 10th Five Year Plan with 88% shortage recorded in EWS and 11% in LIG categories and merely 0.04 million dwelling units in MIG/HIG housing. For the 11th Five Year Plan (2007-12), total housing requirement for urban sector including backlog, was estimated to be 26.53 million dwelling units. Technical Committee also observed 99.9% shortage in EWS, 10.5% in LIG and 0.2% in MIG/HIG categories. Details of housing shortage in urban India at the end of 10th Five Year Plan (2007-12) are indicated in Table 1.

Despite large housing stock being constructed in the country, growing mismatch exists between demand and supply. Demand has largely been concentrated in the low income housing whereas supply focused on the middle and high income groups because of high premium commanded over the low income housing. Housing for the poor/EWS categories is essentially being looked after by the parastatal agencies and to some extent by the private Developers, who are

under legal obligation to provide part of housing stock for Economically Weaker Section category . Developers prefer discharging their obligation in the shape of plots rather than built-up houses, which go beyond the affordability and capacity of the poor to pay for the cost of land and make construction. Accordingly, these opportunities are siphoned off by speculators leading to perpetual housing shortage. However, considering enormous shortage of housing in these categories, this can be leveraged as an opportunity by developers and promoters to create housing stock for LIG/EWS categories, based on affordability and support. Government of India, under Pradhan Mantari Awas Yojna has given numerous options/incentives to private sector, parastatal agencies and individuals to create housing for the lower income groups.

Table 1: Housing Shortage in Urban India*

Category	Monthly per Capita Expend iture in Rs.	Estimated Number of House holds in Million (2007)*	Housing Shortage in Million (207)	Percentage Shortage
EWS	0 – 3300	21.81	21.78	99.90%
LIG	3301-7300	27.57	2.89	10.50%
MIG	7301-14500	16.92	0.04	0.20%
HIG	14501 and above			
Total Shortage		66.3	24.71	37.30%
(*Source: Report of the Technical Group (11th Five Year Plan: 2007-12) on Estimation of Urban Housing Shortage				

ISSUES FACING PROVISION OF HOUSING

Housing as a sector is very complex, being labor, time and capital intensive, with land and construction as the major components. Considering the multi-lateral implications of the housing, there are large numbers of economic, regulatory and urban challenges in developing the appropriate housing in quantity and quality. Ever rising cost of land / construction, delayed approvals, cost of money, outdated technologies and lack of resources are the major constraints on the supply side whereas high cost and lack of access to home finance on the demand side, have emerged as the major roadblocks in supplying adequate number of houses in the affordable category. Major issues identified as the roadblocks in development of affordable housing are enumerated below:

Inefficient Market Land – With merely 2.4% of global land supporting 16.7% of world population, India is precariously placed in the context of land man ratio. There is a perpetual shortage of land needed to meet the basic essentials of more than 1.21 billion Indians for food, clothing and shelter. With rapid growth in population, urbanization, migration and industrialization, pressure on the land is increasing rapidly. With low land-man ratio, ever rising demand and numerous constraints emerging out of speculation, legal framework, pattern of settlement planning and building bye-laws, supply of developed urban land is diminishing very fast, making the land and shelter highly unaffordable in the process. Major factors leading to operational inefficiency in the land market have been identified as:

- Excessive government controls on the development of land.
- Poor availability of marketable land parcels
- Large encroachments on public land
- Outdated land information and management system
- Cumbersome legal framework for sourcing land

Rising Threshold Cost of Construction - due to ever rising cost of building materials, labor, transportation, government levies, taxes and charges, high cost of borrowed money etc, cost of housing is rising rapidly.

High Government Charges - Taxes, fees etc. levied for change of land use, layout/ building plan approvals, licensing, internal/ external development, registration of land / finished house make the house expensive.

Rigid Land Use Planning - Involving Master Plans, Development Plans, Controlled Area Plans and Zoning Regulations locks/freezes the urban land.

Irrational Building Bye-Laws –Low floor area ratio/population density/height has led to promoting operational inefficiency of land utilization, use of cost- effective/state of art building materials and construction technologies.

Low Priority to Project Approvals—Delayed projects and building plans approvals (16-24months) leading to time and cost over- runs of projects.

Lack of Access to Housing Finance - For low income groups due to non-availability of documentations involved in approvals based on providing securities, proof of assured sources of income and residential address etc.

Multiplicity of Agencies and Laws involved - In the approval and regulations of projects.

Lack of Rental Housing- Due to outdated rent laws favouring tenants

Limited Involvement of Private Sector

Outdated Technologies and Conventional Methods of Construction and project planning and management leading to wastage, delay and raising cost of housing.

Lack of Integration between Development and Housing- leading to perpetual shortage of low income housing in the industrial/commercial areas.

One Solution Fit All- assuming every person needs a standard housing accommodation irrespective of the need

Assuming Right to Shelter includes Ownership, Right to Land and Property

Presuming Government is under Obligation to provide Housing to All

Absence of Housing for Urban Migrants/ Informal Sector-leading to houseless-ness and growth of slums

Forced Eviction—of slum dwellers, due to development etc. leading to loss of large number of housing stock.

Lack of Standardization and Mass Production of Housing Components

WAY FORWARD

Approach to Housing

The United Nations Committee on Economic, Social and Cultural Rights has underlined that the right to adequate housing should not be interpreted narrowly. Rather, it should be seen as the right to live somewhere in security, peace and dignity. The right to adequate housing should include;

- Right to enjoy decent and proper housing.
- Right, both for personally and family, to a dwelling of adequate size that meets satisfactory standards of hygiene, comfort and privacy.
- Right not to be arbitrarily deprived of a home by demolition or arbitrary evictions.
- Right to have access to adequate housing.

Promoting Adequate Housing

UN Habitat Report further recommends that countries must graduate from affordable housing to the concept of adequate housing because a house is much more than four walls and a roof. For any housing to be adequate, it must, at a minimum, meet the following criteria:

- Security of tenure: Guaranteeing legal protection against forced evictions, harassment and other threats.

- Availability of services, materials, facilities and infrastructure: Assured access to safe drinking water, adequate sanitation, energy for cooking, heating, lighting, food storage or refuse disposal.
- Affordability: Not threatening or compromising the occupants' enjoyment of other human rights.
- Habitability: Guaranteeing adequate space, as well as protection against cold, damp, rain, wind, other threats to health and structural hazards.
- Accessibility: Taking care of specific needs of disadvantaged and marginalized groups
- Location: Ensuring easy access to employment opportunities, health-care services, schools, childcare centers and other social facilities, and not located in polluted or dangerous areas.

Making Housing for all a Reality

To make housing for all a reality, following approach is suggested :

- Making land market more efficient-by promoting/digitizing/computerization land records, using GIS, creating efficient dispute redressal mechanism and proper implementation of master plans for sourcing land at lower cost by Developers for creating large stock of adequate housing.
- Providing 'Single Window Clearance' of projects on time bound basis.
- Granting additional FAR and higher densities-- by rationalizing building bye-laws/ zoning regulations for construction of more affordable houses.
- Creating Land Bank
- Promoting strong Project and Cost Management- to increase speed and reduce cost of construction besides eliminating cost over-runs.
- Promoting Standardization of building components to promote cost/time efficiency based on prefabrication and mass production.
- Bringing state of art construction technologies and using cost effective locally produced building materials for creating large/green housing stock at competitive cost
- Long term tie up for supply of conventional building materials
- Taking up large housing projects with number of units ranging from 1000-1500 for promoting economy of scale.
- Rationalizing /Reducing Government levies/ charges
- Promoting institutional approach involving enablers, providers and executors to make them work on a single platform to promote synergies for achieving the defined objective of creating affordable shelter.
- Creating affordable housing zones in city plans and develop them on a time bound basis.
- Promoting rental housing schemes in urban areas.
- Creating multiple housing options- night shelters, dormitories, bachelor accommodation institutional housing
- Separating right to shelter from right to ownership of shelter
- Promoting flatted rather than plotted development.
- Reducing cost of house through design intervention using high efficiency structural system, pre-cast / pre-fabricated building components, minimizing public health services

- Creating Housing for Migrants - Housing migrants, constituting major chunk of urban population (43% of population of Delhi and Mumbai), by making adequate housing provision on priority basis by involving large enterprises; creating informal settlements in villages / periphery; partnering with corporate private providers and making provision like working women's hostels, night shelters, bachelor accommodation, dormitories etc.

- Creating Progressive realization of the right to adequate housing —Considering the magnitude of problem / limitations imposed by resources, Government should adopt the strategy for achieving progressively the right to housing rather than providing housing for all in one go, to be achieved by allocating maximum available resources, providing basic services and ensuring that public housing is provided to those who are highly stressed, with their active participation in design / implementation.

CONCLUSION

Enormity and complexity of housing sector in India, calls for urgently redefining the agenda, problem and priorities for achieving the objective of Housing for All by 2022. Conventionally, housing for EWS/LIG sections has been the responsibility of parastatal agencies with limited role assigned to individual beneficiaries. This has to undergo a change by bringing all the stakeholders on a single platform to work for achieving the objective. In addition, priorities will have to be redefined with highest preference going to shelter-less numbering 1.77 million, to ensure that there is no shelter-less person in the country. Further, undue demolition which reduces / destroys the available housing stock should be avoided. Slums which are housing 17% of Indian urban population, need critical review and evaluation, before their housing stock is demolished and rehabilitation schemes prepared. Slums qualifying for in-situ up-gradation, should be permitted with absolute tenancy rights given to eliminate any threat of eviction / demolition. This will help in pooling the resources by beneficiaries to upgrade their shelter. However, state must provide basic amenities and services, improve accessibility, sanitation and access to healthcare, education and open spaces to improve quality of life adopting a co-operative approach with right to transfer the property minimized. Providing housing to all can become a distinct reality by adopting holistic approach involving all the stakeholders based on housing friendly policy framework already put in place and removing existing roadblocks. Role of parastatal agencies shall be that of facilitator / enabler /promoters rather than of provider with key responsibilities given to the private / co-operative / corporate sectors. Implementing reform linked policy framework, would be critical in making affordable housing a reality. Housing sector can be effectively leveraged to create / expand large job market for unskilled / semi-skilled rural migrants; revitalize Indian industry; promote economy; achieving growth rate of 9% and marginalizing poverty in urban India besides making urban centers smart, more productive, effective, efficient, healthier, habitable, better organized, well planned and more sustainable with assured quality of life.

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AFFORDABLE HOUSING IN MASTER PLAN OF DELHI-2021

Dr. Aqil Ahmed* and Vishv Ratan Bansal**

Abstract

Delhi is a historical city and the capital of India for centuries. Being a city of opportunities and commercial fascination, there is regular migration from all over the country, which leads to requirement of affordable housing for the migrants. There is acute shortage of housing, particularly in lower segments and amongst the people belonging to lower strata of the society, which results in emergence of the unauthorized colonies on the Government land, forest and Ridge Land, Yamuna flood plains and the agricultural land.

The paper attempts to explain the provisions of Master Plan of Delhi- 2021 addressing to this housing problem in Delhi and the solution thereof.

INTRODUCTION

As per census 2011, the population of Delhi is 167.53 Lakhs which is estimated to increase to approximately 230.0 Lakh by 2021. Around 2.0 lakh migrants move to Delhi each year from nearby states in search of livelihood and most of them fall in low income group. The shortfall in housing units in Delhi has been estimated to be 5.06 lakh units in 2011, and as per Master Plan of Delhi, 2021, this shortfall is expected to rise to 13.6 lakh by year 2017 and to approximately 24 lakh dwelling units by year 2021. Around 60% of this excepted shortfall is expected to be for EWS housing.

This scarcity of housing has led to origin of unauthorized colonies in all parts of Delhi. At present, there are 1639 unauthorized colonies pending for regularization with the Government and a few hundred more colonies are coming up in various parts of the city, which may also be a problem for the Government as well as to the people.

Delhi, being a Metropolitan city, is highly urbanized in nature and therefore, left out of the scope of Pradhan Mantri Awas Yojna - Rural and only the Pradhan Mantri Awas Yojna- Urban is applicable in Delhi. Master Plan of Delhi- 2021 (MPD- 2021) has, by virtue of its various provisions, tried to address this ever growing need of affordable Housing in Delhi. The housing in Delhi can be categorized into following seven types:

- Homeless
- JJ cluster
- Resettlement colonies
- Unauthorized regularized colonies
- Urban villages
- Walled city area
- Planned plotted development

Delhi Development Authority (DDA), being the principle authority responsible for the development of housing in Delhi, has only been able to meet the housing need of very small section of society. In addition, Delhi Urban Shelter Improvement Board is responsible for upkeepment and upgradation of JJ clusters. Apart from this, a number of private players such as individuals, builders/developers of plotted independent houses as well as large housing projects are also involved

**Exec. Engr. South Delhi Municipal Corporation **Superintending Engineer, North Delhi Municipal Corporation*

in catering to the housing needs of Delhi. However, even their combined efforts have not been able to fulfill the demand supply gap in the housing in Delhi.

PROVISIONS OF MASTER PLAN FOR DELHI-2021

Master Plan of Delhi 2021 has made significant increase in the developmental control norms in various categories of housing and also proposed a number of new initiatives in the housing sector to address the growing need of housing in Delhi, which are discussed hereunder: -

Residential Plot- Plotted Housing

MPD 2021 defines a Residential plotted Development as 'a premises for one or more than one dwelling unit and may have on it one main building block and one accessory block for garages and service personnel.' The development control norms for this category of housing were substantially increased in MPD 2021. The increase in various development control parameters in MPD 2021 is given hereunder:

S. No.	Development Control Norm	As per MPD 2001*	As per MPD 2021
1	Max. Ground coverage	75% to 33.33%	90% to 40%
2	Max. permissible FAR	225 to 100	350 to 120
3	Max. no. of Dwelling Units**	1 to 18	3 to 10 #
4	Max. Height (in mtrs.)	12.5	15

*updated as per various amendments

**restricted as per orders of Hobn'ble Supreme Court of India

This increase in developmental control norms in planned plotted residential development have played a significant role in catering to the needs of housing for lower and middle classes.

Residential Plot - Group Housing

MPD 2021 defines Residential Group Housing as 'a premises of size not less than 3000 sq.m. in area, comprising of residential flats with basic amenities like parking, parks, convenience shops, public utilities etc. The maximum ground coverage allowed is 33.3% with maximum Floor Area Ration (FAR) as 200 and Non-restricted Height (Subject to clearance from AAI / Fire Department and other statutory bodies). Parking norms to be followed are 2.0 ECS/100 sq.m. of built up area. This minimum size requirement is reduced to 2000 sq.m. for slum/JJ rehabilitation, and 1670 sq.m. for Redevelopment areas/Rehabilitation areas/special areas/Village (Lal Dora /Firni/ Extended Lal Dora). Various other provisions for the Group Housing Residential Plots are: -

- The density may vary (10% variation permissible in all categories) for specific categories as given below: a) Category I (upto 40 sq.m) - 500 DUs / Ha. b) Category II (above 40-upto 80 sqm) 250 DUs / Ha. c) Category III - 175 DUs / Ha. (above 80sqm)
- Plots for group housing should be located on roads facing a minimum width of 18 m ROW (13.5 m ROW for redevelopment areas and 9m ROW for Slum Rehabilitation / Special Area and Villages).
- Additional floor area up to a maximum of 400 sq.m shall be allowed to cater to community needs such as community / recreational hall, crèche, library, reading room and society office. In addition to above, 100 sq.m. area shall be permissible for Senior Citizen Recreation Room.
- The Central Government in consultation with the DDA may relax density and other norms for public housing and projects of national importance.
- The developer shall ensure that minimum 15% of FAR or 35% of the dwelling units, whichever is more, are constructed for

Community-Service Personnel / EWS and lower category. Such flats should have a carpet area between 25 - 40 sqm.

- This 15% FAR or 35% of the Dwelling Units for Community Service Personnel / EWS and lower category housing would be over and above 200 Permissible FAR and density mentioned at (i) (a), (b) & (c) above. Employer Housing of Central Government, State Government and other Government Agencies are not required to follow the requirement of FAR or Dwelling Units for Community Service Personnel / EWS and lower income category.]
- Ground coverage up to 40% may be allowed to achieve low-rise high-density housing without lifts.
- Levy on additional FAR shall be at rates notified with the approval of Government from time to time.
- Stilts: If the building is constructed with stilt area of non- habitable height and is proposed to be used for parking, landscaping etc., the stilt floor need not be included in FAR and shall be counted towards height.
- Basement, if constructed, and used only for parking, utilities and services shall not be counted towards FAR.

Cluster Court Housing

For Cluster Court Housing, the minimum size of the plot has been specified as 3000 sq.m.. The maximum Floor Area Ratio (FAR) allowed is 175 and maximum height restricted to 15 m., with maximum coverage 100% subject to light and ventilation conditions. Various other provisions for this category of housing are:

- The net housing density permissible shall be 225 DUs per Ha., with 15% variation on either side and could be averaged for more than one pocket.
- Minimum street in front of pocket to be 12m.
- No projection outside the building envelope allowed.
- Each cluster court house is for one dwelling for a single family.
- Basement:
  - a) Basement if constructed shall not be included in FAR calculations.
  - b) Basement shall be below the ground floor. Basement area may, however, be extended below the internal courtyard and shaft.
- Stilts: If the building is constructed with the stilt area of non-habitable height and is proposed to be used for parking, landscaping etc., the stilt floor need not be included in the FAR but would be counted towards height (within stipulated height).
- Parking: Parking shall be provided as per group housing norms.
- Density: For the purpose of density calculations, the dwelling unit shall be considered to accommodate 4.5 persons and the servant quarter to accommodate 2.25 persons.
- Servant quarter: No separate servant quarter block or servant quarter as part of main building shall be allowed if the garage block space is merged with the main building. Provision for a servant's room as part of the dwelling unit within the permissible coverage and FAR shall be allowed with maximum size of servant quarter as 25 sqm and if larger in size would be counted as a full dwelling unit

Industrial Plot - Group Housing

Master plan 2021 provides for redevelopment of Industrial plots, where Industrial activities are now banned, into other use premises, subject to certain conditions. In case of the industrial plots being

redeveloped into residential use i.e. Group Housing, the incentive in the shape of enhanced FAR upto 50% over and above the applicable norms is allowed i.e. an FAR of 300 instead of permissible 200 is allowed in such cases.

As in the case of Group Housing on a Residential plot,, the development entity will have to construct EWS houses equivalent to 15% of the FAR which will be over and above the permissible FAR of 300. Again, out of this additional FAR of 15%, half of the flats are to be handed over to the Delhi Development Authority on CPWD plinth area rates to be allotted by the DDA to EWS strata of society. Remaining half flats are to be sold by the developer to the people belonging to EWS section.

Rest of the provisions remains same as in the case of Group Housing Society on Residential plots.

Transit Oriented Development (TOD)

'Transit Oriented Development is essentially any development, macro or micro, that is focused around a transit node, and facilitates complete ease of access to the transit facility thereby inducing people to walk and use public transportation over personal modes of transport."

The concept of Master plan of Delhi 1962 was based on poly-Nodal, polycentric distribution of work centers, largely based on road transport nodes. This resulted in distortion between infrastructure, transport and land use. To overcome this, the concept of TOD has been incorporated in the Master Plan for Delhi 2021.

TOD is generally characterized by compact, high density, mixed use development near new or existing high quality public transportation infrastructure that provides housing, employment, entertainment and civic functions within walking distance of the transit system. Pedestrian oriented design features of TODs encourage residents and workers to use their cars less and ride public transit more.

In this context, the MRTS corridors upto 500 m depth on either side of the MRTS are to be selectively re-developed. To incentivize such re-development an enhanced FAR of 400 is permissible in the TOD. However, within TOD Zone, a minimum of 30% of overall FAR shall be mandatory for Residential use. The component comprises of 50% units of size ranging between 32-40 sqm and the balance 50% comprising of homes < 65 sqm.

However, TOD policy is yet to be implemented practically as the detailed regulations for operationalization of the TOD policy including process and time frame for participation are under process of approval and notification.

Land Pooling Policy

Prevailing land policy allowed for development of land which was acquired and subsequently planned by DDA. As such, the layout plans were prepared by DDA as per MPD and ZPD only for the acquired land pockets. This approach has led to the exclusion of lands, which fell under the private domain from the development process, due to various reasons such as de-notification from acquisition /left out from acquisition/legal encumbrances etc.

MPD 2021 has focused on the critical reforms in the prevailing land policy and on facilitating Public Private Partnership. This policy enunciates the need and lays down the guidelines that will enable the participation, in the process of planned development of Delhi, of those private land owners, who were otherwise devoid of the legitimate and rightful use of their property.

This policy shall apply to the Land parcels that could not be acquired during the process of Land Acquisition during the preparation of the MPD or the Land parcels that could not be acquired by DDA because:

(a) Acquisition proceedings were challenged by the land owners and quashed by the courts.

(b) Acquisition lapsed as per the 'New Land Acquisition Act'

Or Land parcels that were assigned such land uses, as per the ZDP, that restricted their development.

Again, TOD policy is yet to be implemented practically as the detailed regulations for operationalization of the TOD policy including process and time frame for participation are under process of approval and notification.

Housing for Urban Poor

Urban poor, for the purpose of Master Plan, would mainly comprise of inhabitants of squatter settlement and informal service providers such as domestic helps, hawkers and vendors, low-paid workers etc. These include both, existing as well as future migrants and pose the biggest challenge for the housing requirement of the city.

REHABILITATION/RELOCATION OF SLUM & JJ CLUSTERS

Till 2001, the slums were relocated, based on site and service based criteria, and 12.5 sq.m. and 18 sq.m. plots were allotted to the eligible persons as part of rehabilitation programme. This led to a number of aberrations due to which this approach had to be abandoned. MPD 2021 provides following new guidelines for rehabilitation/relocation of a slum cluster:

- Resettlement to be based on built-up accommodation of around 25 sq.m.
- Land shall be used as a resource and developed on private sector participation to the extent possible, with incentivization by way of higher FAR and mixed use.
- Provision of accommodation shall be on cost basis with suitable arrangement for funding. Policy of Free land shall be dispensed with. Tenure rights shall be granted on co-operative societies model.
- In case of relocation, site shall be selected with a view to develop small clusters that is integrated with the overall planned development of the area.
- Community based Organizations and NGOs should be closely involved in the resettlement process.

New Housing for Urban Poor

MPD 2021 provides guidelines for providing the new housing for urban poor. Clause 4.2.3.3 of the MPD deals with the subject and provides that New housing should be in the form of one or two room units, which would be developed through public and private agencies and through Cooperative societies. As this category constitutes bulk of the housing stock that has to be catered at an affordable price to the lowest income bracket as housing for Economically Weaker Sections (EWS), this is often done by cross-subsidization. For this purpose, adequate land would be earmarked for EWS housing. The developers of group housing shall ensure that minimum 15% of FAR or 35% of the dwelling units, whichever is more, are constructed for Community-Service Personnel / EWS and lower income category. Employer Housing of Central Government, State Government and other Government Agencies are not required to follow the requirement of FAR or Dwelling Units for Community Service Personnel / EWS and lower income category. In old built up areas, this may be as redevelopment schemes or industrial housing, etc., whereas, in urban extensions, the acquisition and development cost of this land should be borne by rest of the project. Such reserved lands should be handed over to a designated agency for promoting housing for low income and weaker sections. The pattern of EWS housing shall be such as to ensure optimal utilization of land in a sustainable manner. For that purpose, multi- storied housing will be the preferred option. Apart from mandatory provision for EWS housing in all group housing projects/ schemes, the primary responsibility for creating adequate stock of housing for urban poor shall be borne by public agencies.

In-situ redevelopment of Slum & JJ Clusters.

DDA in the year 2004 ran schemes for rehabilitating slum dwellers through re-development/ upgradation of the existing areas of Delhi like Narela, Dwarka etc. in order to make Delhi slum free and provide these people a house with hygienic conditions. Unfortunately such schemes did not take off because there were no jobs available nearby. These slum dwellers used to come back again and again as they had no choice of getting jobs around. DDA finally came out with in-situ slum rehabilitation policy wherein the re-settlement will be done on the land occupied by jhuggi-jhonpri clusters with private partnership. The land will be sold through the tender process to a private partner for construction of multi-storey houses. The number of storey's will depend on the availability of land. Again, in order to facilitate the redevelopment process, incentive in terms of higher FAR and mix land use is allowed. Some of the salient features of the scheme are:

- Minimum plot size should be 2000 sq.m. abutting a road of minimum 9.0 m ROW
- Maximum 900 Dwelling units/ha on the residential component of the plot
- Composite scheme with overall maximum 400 FAR on the residential component of the land and FAR on the remunerative component will be as applicable for the relevant land use.
- Mixed Land use component upto 10% of the permissible FAR in the residential component of the land. Additional 10% of the permissible FAR permitted for house based economic activities for the beneficiaries of the project scheme.
- Minimum residential component of the land area shall be 60% and maximum remunerative component shall be 40%.
- Area of dwelling unit shall be min. 25 sqm to max. 40 sq.m.
- Common Parking for residential area shall be 0.5 ECS/100sq.m. Parking for remunerative component to be as applicable for the relevant land use.
- No restriction on Ground coverage except for setbacks.
- Mandatory approvals to be obtained and other requirements for differently abled persons as well as social and physical infrastructures to be provided as per norms.

HOUSING PROVIDED BY THE GOVT / DDA

DDA commenced its housing activities in 1967 and has played a crucial role in providing more than a million houses to the people of Delhi. Since1967 to till date DDA has allotted about 4,00,000 DDA flats and about 10,000 plots through draw or by inviting the bids. DDA has also allotted land to Cooperative Group Housing Societies registered under the Delhi Coop.Act-1972 Allotment of land to- 116 societies has been made so far.

This figure is not very large as compared to the existing estimated houses in Delhi which are about 5.5 million. From this it is very clear that there is a gap between the demand and supply of the flats and the Govt agencies have been able to provide houses / plots to only a very small percentage of people.

COMPARISON OF THE FAR OF MAJOR CITIES OF INDIA

In many developed cities of the world like Hong Kong, Singapore, New York, Tokyo, Rio de Janeiro, the FAR allowed for housing projects is much higher as compared to what is permissible in Delhi as per MPD 2021, due to which there have been housing projects in the shape of sky-scrappers in these cities. This factor is not only fulfilling requirement of housing of the people but also improving the skyline of the city. In Mumbai also, FAR is much higher as compared to Delhi because, there is provision of saleable FAR in lieu of the

acquisition of land which can be sold to the builder or development entity in another project. This leads to increase in the FAR of a particular project thereby resulting in more number of flats.

It is these reasons which have resulted in planning of a now under-construction 117 storied building in Mumbai, which, when completed, will be the highest residential building of the world. If such projects are encouraged and increased FAR is given, the problem of housing needs of the society can be fulfilled up to a certain extent.

The FAR of 10 major cities of India is given in the Fig.1.

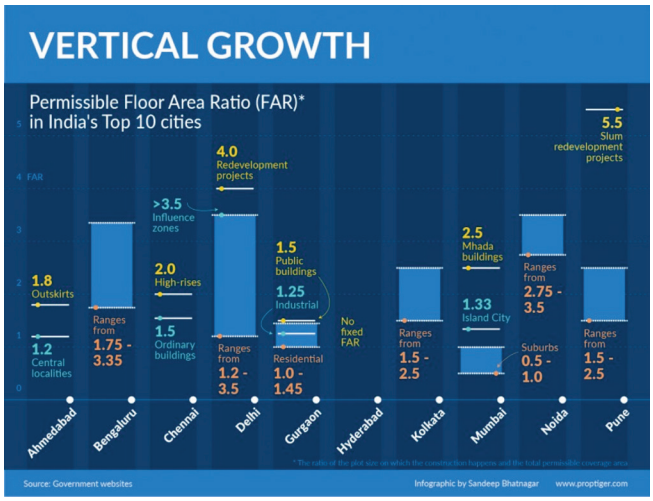

Fig. 1: FAR of 10 Indian Cities

(Note Figures to be multiplied by 100)

In the above Fig.1 the FAR of Delhi is shown as 400 for the redevelopment projects which is yet to be implemented in the projects.

Locality	FSI for	
	Residential plots	Commercial plots
Manhattan CD-8	6.26	11.93
Mumbai C Ward	2.26	2.09

Fig. 2: FAR Comparison of Mumbai with Other Cities

In the other cities of the world, Fig. 2 FSI (or FAR) in much of the central city is 1.33, while in London's CBD, it is 5.5. In Singapore's CBD, it is 25, in New York's CBD, it is 15, in San Francisco's CBD, it is 9 and in Hong Kong's CBD, it is 15. All these values are very high if compared with the cities of India.

RESULTS AND DISCUSSION

From the facts and figures it can be easily said that that due to less number of houses, the following issues have come up:

- Origin of unauthorized colonies
- Encroachments on the Govt lands
- Development of areas in violation of the provisions of master Plan / Zonal Plan
- Excessive pressure on the infrastructure
- Encroachment on the water bodies
- Excess deviation in Construction of buildings

CONCLUSION

From the facts mentioned above, it can be easily construed that the FAR given in the Master Plan of Delhi-2021 is too less to fulfill the housing needs of the people. Due to this reason large number of unauthorized colonies have come up over the Govt Land, DDA land, Forest land, Yamuna flood plain etc which is a grave danger to not only the planning of the city but also to the environmental issues of the city.

To cater such a large population, the FAR has to be increased in tune with the developing cities of the world like New York, Singapore, Hongkong etc.

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HOUSING FOR ALL AND CHALLENGES AHEAD

Dr. K. M. Soni* and Usha Batra**

Abstract

Government of India under Pradhan Mantri Awas Yojana has announced scheme of viable affordable housing for economically weaker sections and low income group people to provide housing for all and to remove urban slums. Two major schemes have been implemented as "PMAY-Urban" for urban areas and "PMAY-Gramin" for rural areas and are to be implemented as a mission, both by Central government and by State governments.

Considering financial status of economical weaker sections, the government has announced multiple options for such people to finance the housing so that it can be implemented by the governments, private builders and even by individuals. Therefore, government has already taken steps to make the mission feasible. Now, it is up to the state governments, urban local bodies and public to implement the schemes to make them successful.

As engineers and individual owners are to implement the schemes, quality of construction needs to be ensured. Simultaneously availability of construction workers, sand, aggregate and cement is to be planned through training to workers, making use of products from construction and demolition waste and using pre-fab products with steel structures.

INTRODUCTION

Government of India has announced Pradhan Mantri Awas Yojana (PMAY)-Urban and PMAY- Gramin under "Housing for all by 2022" mission. PMAY-Urban was announced on 25th June 2015 while PMAY-Gramin on 01.04.2016. Before announcement of PMAY-Urban, Rajeev Awas Yojana (RAY) was in force for "Slum free India" from June 2011 and prior to that, slum rehabilitation was part of Jawaharlal Nehru National Urban Renewal Mission (JnNURM). Period of 2011 to 2013 was kept as preparatory phase for RAY and of 2013 to 2022 for implementation which was also to be implemented in a mission mode. Rental and transit housing was also admissible under RAY. RAY was also to extend financial support to States for creation of affordable housing stock through public-private partnership (PPP) under the Affordable Housing in Partnership (AHP), a component of the scheme. The scheme was applicable to all slums within a city, whether notified or non-notified including identified and recognised, whether on lands belonging to Central Government or its undertakings, autonomous bodies created under the Act of Parliament, State government or its undertakings, ULBs or any other public agency and private sector. It was also applicable to "urbanized villages" inside the planning area of the city, urban homeless and pavement dwellers. The scheme included in situ development, up-gradation, and re-location by way of pucca houses having an area of 21-27sqm. Rental housing (having area between 16-20sqm and in exceptional cases 21-27sqm) was also included for the tenants of slums, labourers, floating population and urban homeless. The model for implementation was through beneficiary led execution, ULBs or parastatal agencies. Funding pattern was 50:25:25 and 75:15:10 between central government, state government, and the beneficiaries for housing in plain areas having population 5 lakhs and above, and less than 5 lakhs respectively. Cost of infrastructure development was to be shared between central government, state government and ULBs. In order to increase affordable housing stock, as part of the preventive strategy, AHP was to be implemented as a part of the scheme. Central support was to be

**Chief Engineer, WZ-I, CPWD, Mumbai **Additional DG (Arch), CPWD, New Delhi*

provided at the rate of Rs 75,000 per EWS/LIG dwelling units of size up to 40 sqm for housing. A project size of minimum 250 dwelling units was considered under the scheme. The Interest Subsidy Scheme for Housing the Urban Poor (ISHUP) was proposed to be continued as a central sector scheme and called Rajiv Rinn Yojana (RRY) in the 12th Plan period which provided interest subsidy of 5% on long tenure loans of 15-20 years limited to Rs 5 lakh borrowed by the EWS/LIG; with ceiling of Rs 8 lakh loan for LIG making housing loan cheaper for this segment. Projects and beneficiaries getting assistance under RAY were also eligible for assistance under RRY.

Before, launch of RAY, JnNURM was launched in 2005 for a seven-year period i.e. up to March 2012 to encourage cities to initiate steps for bringing phased improvements in their civic service levels. JnNURM primarily had two sub-missions viz improvement of urban infrastructure and governance with a focus on water supply and sanitation, solid waste management, road network, urban transport and redevelopment of old city areas and basic Services to the Urban Poor (BSUP) with a focus on integrated development of slums.

For rural sector, Indira Awas Yojana (IAY) was launched during January 1996. This scheme has now been restructured as PMAY-Gramin as in 2014 CAG pointed out gaps in IAY as non-assessment of housing shortage, lack of transparency in selection of beneficiaries, low quality of houses, lack of technical supervision, lack of convergence, non-availing of loans by the beneficiaries and lack of mechanism of monitoring etc. To address these gaps, PMAY-Gramin has been commenced by restructuring into "Housing for all by 2022" with effect from 01.04.2016. PMAY-Gramin has an objective to provide villagers a pucca house, with basic amenities, to all houseless or having katcha/dilapidated houses by 2022. It was planned to cover one crore household living in kutcha house/dilapidated houses out of about 3 crores, in three years from 2016-17 to 2018- 19. The minimum size of the house has been kept as 25sqm with a hygienic cooking space. The unit assistance has been earmarked to Rs. 1.20 lakh in plain and Rs 1.30 lakh in hilly states, difficult areas and selected tribal or backward districts. The beneficiary is also entitled to 90-95 person day of unskilled labour from MGNREGS. The assistance for construction of toilet can be leveraged though convergence with Swachh Bharat Mission - Gramin (SBM-G), MGNREGS or any other dedicated the source of funding. The cost of unit assistance is to be shared between Central and State government in the ratio 60:40 in plain areas and 90:10 for North Eastern and the Himalayan states. Once of the most important features of PMAY-G is the selection of beneficiary. To ensure that assistance is targeted at those who are genuinely deprived and that the selection is objective and verifiable, PMAY-G instead of selecting the beneficiary from among the BPL households selects beneficiary using housing deprivation parameters in the Socio Economic and Caste Census (SECC), 2011 date which is to be verified by the Gram Sabhas. Towards better quality of construction, setting up of a Nation Technical Support Agency (NTSA) is also envisaged.

STATUS OF HOUSES CONSTRUCTED UNDER JnNURM AND RAY

As per the report published on 21st Jul 2016, New Delhi of PTI, over two lakh houses, constructed under JnNURM and RAY, have been lying vacant across the country as was told in the Rajya Sabha, "Construction and allotment of houses under JnNURM and RAY is responsibility of the states and UTs concerned. 2,17,953 houses constructed under JnNURM and RAY all over the country are lying vacant," On 4th Dec 2015, New Delhi , DNA reported that the poor are not interested in a large number of houses built by the government in big cities and towns and as many as 98% of the houses built in Delhi under the JnNURM and RAY were lying vacant. The vacant houses accounted for 79% in Madhya Pradesh, 78% in Punjab, Himachal Pradesh (63%), Chhattisgarh (48%), Maharashtra (43%), Sikkim (43%), Andhra Pradesh (38%) and Telangana (29%). Under JnNURM and RAY, a total of 1,695 housing projects were sanctioned at a total cost of Rs 40,536 crore, involving central assistance of Rs 21,101 crore, for construction of 13,92,589

houses. As many as 9,80,216 dwelling units under the two schemes have been completed, but 2,37,546 of them, which is one-fourth of the houses built, are not yet occupied by the beneficiaries. The highest number of 52,966 vacant houses out of 1.23 lakh is in Maharashtra, followed by Gujarat where 29,126 out of 1.18 lakh houses are vacant and Delhi where 26,759 out of 27,344 houses are unoccupied. Other states with poor vacancies are Madhya Pradesh, Andhra Pradesh, Telangana, Uttar Pradesh, Chhattisgarh, Tamil Nadu and Karnataka.

PMAY-URBAN

The scheme is particularly for economically weaker sections (EWS) and low income groups (LIG) through affordable housing. Slum households, estimated to be about 18 millions, being from economically weaker sections are covered under the scheme with non slum dwellers of LIG category estimated to be about 2 millions. PMAY was planned to be implemented in 3 phases. Phase 1 was planned from April 2015 to March 2017 covering completion of affordable housing in 100 cities, phase 2 starting from April 2017 and ending in March 2019 covering another 200 cities and phase 3 between April 2019 and March 2022 for remaining cities.

The scheme is to be implemented through following models;

- Through "In situ" slum redevelopment in which land is to be used as a resource with private participation, and allowing extra FSI/TDR/FAR if required, to make projects financially viable.
- In second model credit linked subsidy is provided for affordable housing. Interest subvention subsidy is granted for EWS and LIG for new houses or incremental housing.
- Third model for affordable housing is in partnership with private sector or public sector including parastatal agencies in which central assistance per EWS house in affordable housing projects is available where 35% of constructed houses are for EWS category.
- Fourth model includes subsidy for beneficiary led individual house construction of individuals of EWS category requiring individual house for which states are required to prepare a separate project for such beneficiaries but no isolated/splintered beneficiary to be covered.

Central assistance is planned to be provided to urban local bodies (ULBs) and other implementing agencies through states/UTs for in-situ rehabilitation of existing slum dwellers using land as a resource through private participation, credit linked subsidy, affordable housing in partnership and subsidy for beneficiary led individual house construction/ enhancement. A subsidy of Rs 1 lakh to Rs 2.30 lakh is provided by the government. The government also provides an interest subsidy of 6.5% on housing loans availed by the beneficiaries for a period of 15 years from the start of loan and preference given to women.

PROGRESS OF PMAY

As per financial Express, 31st May 2017, the government's ambitious project to provide pucca houses to all by 2022 may have to be scaled down, as the progress so far has been rather tepid. After a delayed start in November last year, PMAY-Gramin saw construction of just 885 houses in rural areas in FY17 against initial target of building 44 lakh houses. The ministry of rural development has now extended the deadline for constructing the 44 lakh houses to the end of 2017, but even this plan looks very ambitious. As per the original three-year plan, another 33 lakh houses were to be built in 2017-18, but the government is not in a position to adhere to the target.

The scheme for urban housing (PMAY-U) has also seen slow progress and the government considers it due to delayed land acquisition for this. To meet the objective of housing for all by 2022, the government had launched PMAY-U in mid-2015 to help build affordable houses in cities. However, only about 41,000 houses have been built till end-March 2017, out of the approved 16.3 lakh houses under the scheme by the Centre.

SHORTAGE OF HOUSING

Total housing shortage in the country was projected as 18.78 million in the beginning of the 12th Five Year Plan (2012-17). It was clearly brought out that more than 90 per cent of shortage exists for the EWS/LIG section of society. Also according to a report of earlier Ministry of Housing and Urban Poverty Alleviation, though the shortage of housing units in urban areas was 18.7 million mostly for EWS/LIG category. Now, the government has estimated a shortage of about 18 million houses for EWS and 2 million for LIG category. In rural sector a shortage of 40 million houses is estimates. On the other hand, 11 million houses were lying vacant for higher type of flats for middle income group and high income group indicating very low demand for higher type of quarters.

CHALLENGES

Finance

As already discussed, PMAY will be implemented by four models i.e. "in situ" slum redevelopment, credit linked subsidy, AHP with private sector or public sector including Parastatal agencies and through subsidy for beneficiary led individual house construction.

If demand of EWS flat is considered as 17 million and plinth area as 30 sqm and cost of construction as Rs 20000 per sqm with normal specifications, cost of construction is estimated to be Rs 10,20,000 crore as on today to remove all urban slums. Governments cannot not fund such schemes hence it is decided to use land as a resource.

Private builders will invest in the schemes only if they get buyers for higher category of flats, constructed with flats for slum rehabilitation which are to be provided free of cost. Considering vacant inventory available almost in all the cities, it would be difficult for the builders to get buyers. Public may not invest in property due to recurring maintenance and society charges, property tax, electric cost, low rent and Bank EMIs. Banks and other financial institutions would also find difficult to fund such projects after "The Real Estate and Regulation and Development Act -2016" as there are large restriction on funding the projects though in the interest of public. Thus funding slum rehabilitation may be very difficult in urban areas, particularly large slums.

Shifting of Slums

The government is aiming to shift about 17 million slum urban dwellers to the flats in multi-storeyed buildings. At present, mostly slum dwellers are living in single storeyed construction and thus they also take up commercial/business activities and thus slums are part of their source of income. Such commercial activities cannot be carried out in multi-storeyed flats and thus many slum dwellers may not be willing to shift in rehabilitated projects. Apart from this, many slum dwellers get facilities in the form of subsidized electricity, water, rice, wheat, kerosene etc and such facilities may not get extended once they move to ready built flats. Thus, many of slum dwellers may be reluctant to move in flats.

All the slum dwellers (up to a cut-off date) are to supposed to be provided free flats and as such as the survey is carried out, a jhuggi is divided sometimes in two or three jhuggies so that all three may get free flats and as such survey is challenged frequently by the dwellers and even some politicians support them.

Slum rehabilitation programme is applicable to the slum dwellers who are residing before a particular date and as such the slum dwellers that are not rehabilitated, will have to be dislodged. There is no such scheme for such dwellers and as such a scheme may be required like rental for such slum dwellers to make slum free India.

Scarcity of Land

For slum rehabilitation programme, land is to be used as a resource. Generally slums are with single storeyed construction and as such vacant land will be available once they are accommodated in small land due to construction of multi-storeyed buildings. But for multi-storeyed construction, vacant land is required while slums are normally highly congested areas having no vacant land

hence for "in-situ rehabilitation" land is going to be scarce resource. Also, a builder would like to start construction simultaneously for rehabilitation of slum dwellers and for selling flats to others for recovery of his investment and as such vacant land may be a serious issue. The dimension of the issue may be estimated by considering the requirement of land for constructing 17 million houses for slum dwellers alone. In case, 30 sqm area of each unit is considered with 8 storeyed constructions, and ground coverage is considered as 0.3, land area required will be about 200 sqkm which is almost equal to one third area of Mumbai or more than area of Kolkata.

Property Cards/Documents

Particularly in rural areas, property owners may not have property documents and thus getting subsidy/loans or allowing construction on such land without verification of ownership rights by the state government authorities may be a difficult task. As mentioned earlier, to ensure that assistance is targeted at those who are genuinely deprived, PMAY-G beneficiary is to be verified by the Gram Sabhas. Such a system may give rise to complaints of corruption. Also, there may be problems in rural areas particularly when verification of genuine applicant for the scheme is to be verified by Gram Sabha/Panchayat/Pradhan in absence of ownership documents of the inherited houses. In rural areas, land records are maintained by revenue authorities while development under PMAY-Gramin may be with rural department hence co-ordination is also essential.

Accommodation for Construction Workers

As already mentioned, PMAY requires large construction and such large workforce will be required all over the country, both in rural and urban areas. Construction workers do not have accommodation in the urban areas as most of the workforce is migratory labour from rural areas hence they will require accommodation in the cities and towns. In case, arrangements are not made for them, creation of additional slums on government land cannot be ruled out. Hence, suitable schemes like rental schemes for migratory workers are also required to be developed simultaneously.

Quality of Construction

Quality of construction is going to be yet another issue as even houses constructed under RAY and IAY are lying vacant. It will be difficult for implementing agencies to have strict quality control unless quality contractors and builders are not selected for such works. Pre-fab construction with steel structure should be given priority for quality control and timely completion. It has been observed that maximum houses constructed under JnNURM and RAY are lying vacant in Maharashtra, Gujarat and Delhi which indicates that the people who have better earning capacity will not like to accept houses constructed with sub-standard materials or low quality.

Construction Materials

For such large construction, basic materials like cement, sand and aggregates will be required in large quantities. Therefore, availability of these materials will have to be ensured which may not be sustainable from environmental considerations. Particularly availability of sand and aggregates is seasonal and also it is likely that large quantity of construction and demolition waste is generated from new construction. Hence, all over the country, C & D recycling plants will have to be installed so that use of products from recycling plants is made in such projects.

Technical Personnel and Labour Workforce

Technical personnel and trained workforce will further be a challenge for constructing nearly 50-60 million houses under PMAY in rural and urban areas, particularly up to 2022. Even at present, skilled labour and technical personnel are not available. In rural areas, Panchayats and masons will have to be imparted training for disaster resistance houses without loss of time now.

PRECAUTIONS

The aim of the government is to prevent slums in urban areas and provide a pucca house in rural areas for everyone. But it has to be ensured by proper architectural design and quality in construction, that multi-storeyed slums are not created by the government which may require demolition after 20-25 years resulting into wastage of scarce resources. The government has fixed the limit of 6 lakhs for subsidy under credit linked subsidy hence the beneficiaries are bound to adopt low specifications in the houses.

In present circumstances, the mission of "Housing for All by 2022" will only be feasible if Central government, State governments, ULBS, private builders, contractors, industrialists, workers, technical personnel, financiers, banks and public at large seriously implement the programme in a mission mode. It is good step that in rural areas, the construction has been left on the owners. Nevertheless, the government has taken up the mission in true spirit and even if it is extended by few years, it would prove to be a successful mission for the country.

CONCLUSION

Housing to its citizens has been planned to be the primary responsibility of the government and as such Central government and State governments have decided to implement "Housing for All by 2022" at all levels. This is a welcome step by the governments. Though there may be some difficulties initially, they would be resolved through awareness programmes, adopting quality in construction, sincere implementation by all stakeholders and the mission would prove to be successful.

The need is now to bring together all the stakeholders engaged directly or indirectly on a single platform required in the implementation so that the dream to provide a pucca house to each citizen of the country comes true.

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AFFORDABLE HOUSING: A COMPREHENSIVE APPROACH

Gopal Kumar Johari* and Dr. Gursharan Jeet Kaur**

Abstract

Since the cost of building material and land prices are always on the rise, the provision of affordable housing is an intimidating task. While ensuring the affordability of housing solutions is a prime concern, delivering the houses to the correct target group is equally imperative. For builders and real estate developers, MIGs and HIGs have become an obvious choice, since they are considered bankable. The lack of market support in favour of poor households limits the supply of housing for them and blocks the opportunity of aspiring households, resulting in increasing financial stress, personal underachievement and societal costs.

In order to take this challenge head-on and boost the supply of diverse housing options, the Government of India brought out the National Urban Housing and Habitat Policy 2007 which sought to earmark land for EWS/LIG groups in new housing projects for the provision of affordable housing. Subsequently, schemes like JNNURM, RAY etc. were launched to address the housing related issues. Further, looking at the shortage of housing, Government of India launched a Mission "PMAY - Housing for All (Urban) by 2022" in 2015 and proposed to provide several incentives for affordable housing to the urban poor.

This paper addresses the important issues and aspects of affordable housing along with the review of the Centre level policy framework and regulations for affordable housing. In the light of a growing urban housing shortage estimated at 18.78 million units, the practicability and success rate of existing institutional framework and mode of public private partnership is also highlighted and re-examined through this paper.

INTRODUCTION

Housing is a fundamental necessity and an important component of human settlement planning and development. It is a top priority for any government to address the issue of housing demand. As per 2011 census, India has a population of 1,210.98 million, out of which 377.10 million (31.16%) lives in urban areas. This growing concentration of people in urban areas has not only stressed the existing basic amenities such as water, power and open spaces of the towns and cities, but also led to many problems related to land shortage, housing shortfall etc.

URBAN HOUSING SHORTAGE IN INDIA

According to the 2011 census, the housing stock in urban India stood at 78.48 million for 78.86 million urban households. Though the gap between household and housing stock is narrow, the actual shortage is high. The Report of the Technical Group on Urban Housing Shortage (MHUPA, 2012) has estimated that about 18.78 million households struggle with housing shortage in urban India. According to this Report, 80 per cent of India's urban housing shortage is in the form of existing but inadequate housing that is dilapidated and congested (Kundu, 2012). High prices of land and real estate in urban areas have forced the poor and the economically weaker sections of the society to occupy the marginal lands typified by poor housing stock, congestion and dilapidation.

Across income categories, it is found that almost 96% of the housing shortage is faced by the economically weaker sections (EWS) and low income group (LIG) categories, i.e., households that earn up to two lakhs a year. One of the reasons for this is that private developers primarily target luxury, high-

** Associate Professor, Guru Nanak Dev University, Amritsar &** Architect – Urban Planner, Delhi*

end and upper-mid housing segment, thus leading to a continuous supply for this segment and increasing market competitiveness for developers. The housing for the LIG and EWS is primarily provided by the government for welfare purposes and is insufficient compared to the existing shortage in the segment. Currently, there exists a huge dearth in the supply of affordable houses primarily demanded by this income group in India.

DEFINITION OF AFFORDABLE HOUSING

Since 'affordable' or 'affordability' is a relative concept and have implied several meanings in different contexts, therefore, there is no clear-cut definition of the term 'affordable'.

- According to the RICS Report on Making Urban Housing Work in India, affordability in the context of urban housing means provision of 'adequate shelter' on a sustained basis, ensuring security of tenure within the means of the common urban household.
- According to the KPMG Report on 'Affordable Housing' – Affordable housing is defined in terms of three main parameters, namely income level, size of dwelling unit and affordability which can be correlated to income and property prices. The concept is explained in Table no. 1

Table 1: Definition of Affordable Housing

	Income Level	**Size of Dwe lling Unit**	**Afforda bilityt**
EWS	< INR 1.5 lakhs per annum	Up to 300 sq. ft	EMI to monthly income: 30 - 40%, House price to annual income ratio: Less than 5:1
LIG	INR 1.5 – 3 lakhs per annum	300 – 600 sq. ft.	
MIG	INR 3 -10 lakhs per annum	600 -1200 sq. ft.	

(Source KPMC)

Table 2: Definition of Affordable Housing

	Size	Cost	EMI or Rent
EWS	300 – 600 sq. ft carpet area	Not exceeding four times the household gross annual income	Not exceeding 30% of gross monthly income
MIG	< 1200 sq. ft of carpet area	Not exceeding five times the household gross annual income	Not exceeding 40% of gross monthly income

(Source MHUPA 2008)

Table 3: Definition of Affordable Housing

	Size	EMI or Rent
EWS	• Min. 300 sq. ft super built up area • Min. 269 sq. ft. (25 sq. m) carpet area	Not exceeding 30 - 40% of gross monthly income
LIG	• in. 500 sq. ft super built up area • Min. 517 sq. ft. (48 sq. m) carpet area	
MIG	• 600 -1200 sq. ft super built up area • Min. 861 sq. ft. (80 sq. m) carpet area	

(Source MHUPA 2011)

- According to the Task Force on Affordable Housing set up by the MHUPA in 2008, affordable housing for various segments is defined by size of the dwelling and housing affordability derived by the household income of the population. The concept is explained in Table no. 2

- JNNURM Mission Directorate of MHUPA has also defined affordable housing in its amended Guidelines for Affordable Housing in Partnership released in December 2011. The concept is explained in Table no. 3

It is observed that most of the definitions for affordable housing only consider area, price and affordability of the occupier; however, the key ideas of making affordable housing work through adequate amenities and appropriate location remain unanswered.

In view of the above, Affordable housing can be defined on the basis of four criteria as listed below Table 4.

- Minimum volume of habitation
- Provision of basic amenities
- Cost of the house
- Location of the House

INCOME LEVELS AND HOUSING AFFORDABILITY

The relationship between income and affordability follows a nonlinear trend. The costs on food, non food essentials and house rent form a significant portion of income for lower-income groups. According to the studies conducted, as one move towards higher-income levels, the rise in costs do not increase at the same pace. Disposable surplus income, which is often used to purchase a new house, drops significantly at lower-income levels and is higher at higher-income levels. Thus, people of higher-income levels are in better position to afford the purchase of new houses, owing to higher disposable surplus incomes.

Although the purchasing capacity is lower for lower-income groups, there exists a large demand for housing amongst this segment. However, the present market is characterized by an undersupply of residential products catering to this income segment. The Ministry also states that, in order to be considered 'affordable housing'; a housing unit must not cost more than five times the annual income of the household (MHUPA, 2011). Using this definition, affordable housing for the EWS and LIG must not cost more than 10 lakhs. But the current demand and supply mechanisms of housing do not adhere to this gamut of affordability.

Table 4: Definition of Affordable Housing

	Minimum volume of Habitation	Provision of basic Amenities	Cost of the House	Location of the House
EWS	• Min. 250 sq. ft carpet area • Min. 2250 cu. ft internal volume	• Sanitation, adequate water supply and Power • Provision of community spaces such as parks, schools and health care facilities, either within the project or in the neighbourhood, depending upon the size and location of the housing project	• EMI – not exceeding 30-40% of the gross monthly income. • Reasonable mainten ance costs	• Located within 20km of a major workplace hub/ suburban hubs in the city • Adequa tely connected to major public transit hubs
LIG	• 300 - 600 sq. ft carpet area • 2700-5400 cu. ft internal volume			
MIG	• 600 - 1200 sq. ft carpet area • 5400-10800 cu. ft internal volume			

(Source: Jones Lang LaSalle Research, 2012)

ISSUES IN THE DEVELOPMENT OF AFFORDABLE HOUSING

Development of affordable housing in Indian cities faces significant challenges due to many economic, regulatory and urban issues. Few of the factors which impact the ability of low-income groups to buy housing in the organised sector are listed as follows:

- Lack of availability of urban land
- Excessive Control on Development of Land - Especially in centrally located areas and by making land recycling difficult, some regulations tend to centrifugally push urban development towards the periphery, thus creating artificial shortage
- Rising costs of construction while balancing the amenities provided as well as ensuring the safety and serviceability of the built structure during its lifecycle
- Regulatory issues like long, time consuming approval and land use conversion process.

For example – In order to obtain a plan sanction for a project, the developer has to visit nearly 40 departments starting from central environment, airport authority etc.), state governments (revenue, fire, high rise, environment etc.) and local bodies (water, sewage, traffic etc.)

- Lack of clarity and overlapping guidelines in building bylaws and guidelines makes planning for construction projects difficult.

CENTRAL GOVERNMENT INITIATIVES, POLICY FRAMEWORK AND REGULATIONS

Several policies adopted by Central Government have assisted in the delivery of affordable housing for the EWS, LIG and lower MIG. The first National Housing Policy was formulated in 1988, which was revised in 1994. These policy initiatives focused on transition of public sector role as `facilitator', increased role of the private sector, decentralization, development of fiscal incentives and concessions, accelerated flow of housing finance along with promotion of environment-friendly, cost-effective and pro-poor technology. All this was followed by National Housing and Habitat Policy (NHHP) in 1998, which introduced landmark initiatives such as involvement of multiple stakeholders, repeal of Urban Land Ceiling Act and permitting foreign direct investment in housing and real estate sector.

However, all these policies were generic and applicable to both rural and urban areas. Taking into account the emerging challenges regarding shelter, housing and growth of slums, the Government of India brought out the National Urban Housing and Habitat Policy 2007 which sought to earmark land for EWS/LIG groups in new housing projects for the provision of affordable housing specific to urban areas. Subsequently, schemes like JNNURM, RAY etc. were launched to address the housing related issues.

National Urban Housing and Habitat Policy (NUHHP), 2007

NUHHP 2007 has identified 'Affordable Housing for All' as a key focus area to address concerns that could hamper sustainable urban development. The policy seek to promote various types of partnerships between public, private, cooperative and the institutional sectors in order to attain some of the objectives listed below:

- Focus on affordable housing for all, with focus on economically weaker sections and low-income group categories.
- Emphasis on private sector participation through the use of tools like Transferable Development Rights (TDR), additional FAR etc.
- Creating adequate housing stock both on rental and ownership basis with special emphasis on EWS through appropriate capital or interest subsidies.
- Recognition of the need for subsidy coupled with suitable financial instruments to establish a flow of institutional finance to the poor for housing.
- Reservation of 10-15% of land in every new public/ private housing projects or 20-25% of Floor Area Ratio (FAR) for EWS/ LIG.
- Jawaharlal Nehru National Urban Renewal Mission (JNNURM), 2005

JNNURM was launched with an aim to encourage and expedite urban reforms in India. For the housing sector in particular, its main aim was construction of 1.5 million houses for the urban poor during the mission period (2005–2012) in 65 mission cities

Basic Services for the Urban Poor (BSUP)

The scheme was managed by the Ministry of Urban Development and seeks to provide seven entitlements or services – security of tenure, affordable housing, water, sanitation, health, education and social security to low-income segments in the 65 mission cities

Integrated Housing and Slum Development Programme (IHSDP)

The programme combines the existing schemes of Valmiki Ambedkar Awas Yojana (VAMBAY) and National Slum Development Programme (NSDP) with an integrated approach for improving the conditions of the urban slum dwellers that do not possess adequate shelter and reside in

dilapidated conditions. The scheme is applicable to all cities and towns as per 2001 census except cities/towns covered under BSUP.

Affordable Housing in Partnership (AHIP)

It aims to promote various types of public-private partnerships amongst the private sector, cooperative sector, financial services sector, state authorities and urban local bodies, for realizing the goal of affordable housing for all. This scheme is a part of JNNURM and takes into account the experience of implementing BSUP and IHSDP.

Rajiv Awas Yojana

The scheme for the slum dwellers and the urban poor envisaged a 'Slum-free India' by encouraging states to tackle the problem of slums in a definitive manner. BSUP and IHSDP were included in Rajiv Awas Yojana (RAY) in the 12th five year plan, with the following main features:

- A holistic approach envisaging in-situ rehabilitation of slums so that the livelihood opportunities of the beneficiaries are not disrupted.
- Property rights to slum dwellers by enacting suitable legislation which earmarks 20-25% of developed land in real estate projects for constructing houses for the EWS/ LIG category and also earmarking of at least 25% of municipal budget for the benefit of urban poor.
- PMAY- Housing for All (Urban) by 2022

Inspite of all these schemes in place, looking at the shortage of housing, Government of India launched a Mission 'PMAY- Housing for All (Urban) by 2022' in 2015 and proposed to provide several incentives for affordable housing to the urban poor. The objective is that every family will have access to a pucca house with water connection, toilet facilities and 24x7 electricity supply by 2022. The mission covers all statutory towns of India, seeks to address the housing requirement of urban poor including slum dwellers through four programme verticals, as elaborated below in table no. 5. The mission seeks to provide 20 million housing units and take up slum rehabilitation projects.

Table 5: Four Mission Verticals giving option to Beneficiaries, ULBs & State Governments

"In situ" Slum Redevelopment • Using land as a resource • With private participation • Extra FSI/TDR/FAR if required to make projects financially viable • Central grant of Rs. 1lakh per house, on an average	Affordable Housing in Partnership • With private sector or public sector • Central assistance at the rate of Rs.1.5lakhs per EWS house in affordable housing projects where 35% of constructed houses are for EWS category
Affordable Housing through Credit Linked Subsidy • Interest subsidy for EWS and LIG for new house or incremental housing • EWS: Annual Household Income Up to Rs.3 lakhs and house sizes upto 30 sq.m • LIG: Annual Household Income between Rs. 3 – 6 lakhs and house sizes upto 60 sq.m • Interest subsidy of 6.5% on housing loans availed up to tenure of 15 years for EWS/LIG categories	Subsidy for beneficiary-led individual house construction • For individuals of EWS category requiring individual house • State to prepare a separate project for such beneficiaries • No isolated/ splintered beneficiary to be covered. • Central grant of Rs. 1.5lakhs per house

(Source: Guidelines for Pradhan Mantri Awas Yojna, Housing for All (Urban), MOHUPA, GoI, 2016)

The planning, design and construction of 20 million dwelling units in next six years would require innovations in land assembly, development, planning, design and construction. This also serves as a unique opportunity to introduce state of art processes, such as digital planning, spatial data infrastructure for land management and land pooling, benchmarking, infill

development, single window approval, intelligent and smart services, electronic property transactions, e-governance and capacity building of housing organizations together with the legal reforms in land acquisition, stamp duty, property registration, rent control, and building bye-laws.

PUBLIC PRIVATE PARTNERSHIP IN BUILDING AFFORDABLE HOUSING

Conventionally, housing development for the EWS and LIG sections has been the responsibility of the government. However, in the past few years, private players have increasingly begun to realise the untapped opportunities at this section of the pyramid. State and central government policies are addressing the shortage in housing by providing incentives to private developers in order to create an affordable housing stock. The Affordable Housing in Partnership scheme was introduced as a supply side measure to address housing shortage in cities by preventing the growth of slums. State governments were encouraged to promote affordable housing projects in the public-private partnership (PPP) mode in order to engage competing private developers in the market for affordable housing. In order to do so, they approached the supply of adequate affordable housing through three models:

(1) Projects undertaken on land owned by the central government/states/UTs/ULB/ corporations/ development authorities and executed by state, ULB, corporations/ development authorities.

(2) Projects undertaken in PPP mode where the states/UTs/ ULBs/ corporations/ development authorities provide land and/ or other facilities/ incentives and private sector conceive and execute the project using its financial and technical resources.

(3) Projects undertaken on private land implemented by developers/promoters wherein states/UTs/ULBs/ corporations/ development authorities offer incentives/ facilities like extra TDR/FAR/FSI and/or other concessions.

There are many reasons for the failure of affordable housing wherever implemented. For example in Rajasthan the approach for affordable housing projects suffered, primarily because of location. It was found that not much attention was paid to the geographical location of projects across the city. Developers used their vacant land parcels that had low marketability and weren't being utilised otherwise. But, the lack of social and physical infrastructure coupled with distance from the city centre made it difficult to find buyers for these flats. Therefore, despite completion, occupancy remained relatively low in such projects.

Similarly, the provision of rental housing units in Maharashtra under the PPP model was met with limited success. Several of the units constructed under the Rental Housing Scheme remain unoccupied and are yet to be either sold or allotted to future residents. Many projects were located far away from the city, requiring several hours of travel to reach respective destinations of work. Also the physical and social infrastructure present have been inadequate for the number of households planned, if not entirely absent in many of the projects. The FSI/ FAR allowed in these projects was too high, resulting in the creation of 'vertical slums'. Also, no effective rental housing management system was put in place, thereby making the collection of monthly rent and maintenance of the project highly problematic.

Using appropriately located land parcels with innovative incentives for public agencies as well as private developers can mitigate shortcomings of the PPP model. As government owned land whether Central, State or ULB, is serviced land located well within city limits, projects constructed on them become financially viable for the developer and socially viable for future residents. Affordable housing units constructed under such a model are more likely to be occupied and retained by the intended target group with residents mitigating the potential vulnerabilities through mobility and economic opportunities.

AN INSTITUTIONAL APPROACH TO AFFORDABLE HOUSING

The objective of creating affordable housing is to provide adequate shelter to all. Creation of affordable housing should encompass both – enabling people to buy and to rent, for which there is a need to put an institutional structure in place. The present models on which affordable housing is being created concentrate on the ability of people to buy. These models require a numerous agencies from public and private sectors to work together for the development of affordable housing.

Private sector, which comprises residential developers, develops affordable housing projects and sells them in the open market. People who look to buy houses in urban areas are mainly those who have been in the city for a considerable amount of time and require new houses due to growing family size. Thus, this model addresses only a part of the target segment that needs affordable homes. Also, by using this model, there is no guarantee that the beneficiaries of such projects are the actual needy people or speculative investors.

Another target segment that requires affordable homes are city migrants who cannot afford to buy houses immediately but are capable to rent housing premises. Such people require a differentiated approach towards affordable housing. The three main groups – Enablers (Self Help Groups, NGOs and registered societies to identify the genuine user groups), Providers (ULBs, financial institutions, government departments and research institutes) and Executors (Private developers, Public Sector Undertakings (PSUs) and Public Private Partnership (PPP) firms) are required to work in sync with each other to make affordable rental housing. A common thread is required to bind these groups together such that they are able to work in a unified manner and reach the actual target group.

A comprehensive framework needs to be established incorporating following aspects in ensuring the development of affordable housing.

- Formulate guidelines for identifying right beneficiaries for affordable housing projects - It would help in ensuring the reach to right beneficiaries and avoid involvement of speculative investors into the projects. Creation of the National Population Register and issuance of unique identity through Unique Identification Authority of India will become crucial steps in identification of right beneficiaries, if they are linked with income levels.

- Effective financing by utilising the reach of Self-Help Groups (SHGs) and other innovative financing mechanisms is another way to ensure that housing finance is available to large sections of LIG and EWS populations. Flexible payment mechanisms should be put into place, as households in low-income groups typically have variable income flows.

- Provision of Incentives for developers - ULBs and UDDs can develop guidelines by giving free sale areas, extra Floor Space Index (FSI) and other policy measures so that real estate developers are incentivized to develop affordable housing. The cost-benefit analysis of regulations should be carried out from a development perspective to ensure that schemes to facilitate the development of affordable housing are feasible.

- Streamline land records to improve planning and utilisation of land - Adequate availability of land should be ensured for housing and infrastructure by computerisation of land records, use of Geographical Information Systems, efficient dispute re-dressal mechanisms and implementation of master plans.

- Technological solutions, project financing and delivery from private sector - This reduces costs of construction significantly despite rising costs of inputs. As construction costs form a significant portion of the selling price of affordable housing units, the savings in construction can immensely benefit the occupier.

CONCLUSION

Affordable housing built under the public private partnership model is facing limited success in achieving its purpose, i.e., reducing the existing urban housing shortage. It is crucial to intervene at this particular point in time as several states are either in the process of formulating or are rethinking their approach towards addressing urban housing shortage. Guidelines for affordable housing projects need to be reframed to include incentives not just from the supply side but also for potential future residents. A way to do this is to ensure appropriate site selection for the construction of new housing units as much as possible. Proximity to an existing urban settlement, coupled with public transport facilities, should be maintained as it enables employment opportunities. Sites provided with adequate physical infrastructure services such as electricity, water supply and sanitation lines, and social infrastructure in the form of schools and health facilities help in

creating liveable conditions that often result in high occupancy rates. Housing cannot be delinked from mobility and employment as people utilise their dwelling units not just as places to reside but also as spaces to work and generate livelihoods.

It is not possible to eliminate urban housing shortage completely as market forces coupled with migration and population growth will always leave a certain percentage of the population with housing that is either inadequate or unaffordable. However, it is always possible to ensure the formulation of systems and practices that takes care of the diverse nature of this housing demand and are capable of adapting themselves to it.

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CONCEPT AND PLANNING FOR MASS HOUSING

Sanjeev Kumar Verma* and Prakash G. Rode**

Abstract

The term "Mass Housing" has its roots in twin concepts floated very recently by some Government entities for boosting housing stocks in urban areas. One concept is to devise policies which would allow additional "Floor space Index" over and above the base F.S.I. of 1.0 (one) to raise financial resources for the concerned Government bodies and at the same time incentivise private sector entities to undertake construction of "Mass Hosing". States like Maharashtra have granted F.S.I. as high as 4.0 (four) for their "Rental Housing Scheme" which is based on space sharing modal of development and intends to boost affordable housing stock through private sector participation.

Construction technologies started evolving in quest of better quality and speed of construction and this evolution process, in its wake, ushered in the concept of "Mass Housing". Advent of newer technologies of construction like "Aluform" and "Pre-cast" mandate a certain minimum project size and volume of construction for optimising cost of procuring "Aluform" shuttering and establishing a "Pre-casting yard" respectively.

Planning for "Mass Housing" requires careful consideration of many aspects so as to improve functionality and customer satisfaction. Planning also requires leveraging all development control provisions to maximise tenements density as land resources are fast diminishing. "Mass Housing" projects must, therefore have to be, precisely conceptualised, economically designed and have robust planning.

INTRODUCTION

The purpose of this paper is to explore various aspects involved in the development of mass housing projects ranging from the evolution of today's 'Mass Housing', from the seeds of rushed construction of dwellings planned in the aftermath of the industrial revolution and end of World War II that left hundreds of thousands homeless, to the various policies and legislations trying to derive the formula to achieve 'Housing for All' by 2022. First of all we need to understand a few concepts regarding housing in general, and "Mass Housing" in particular.

How would you define a 'Good Housing Development'? The answer lies in the 'quality of space'. "Housing spatial quality" deals with the creation of the complete, compact, functional and attractive central public spaces in the new or re-converted residential structures, which can be comparable with the attractiveness of historical central areas of old cities.Optimal integration of the local sources and neighbourhood connections contributes to the design quality of a housing environment that is rich and stimulating. Thus the level of spatial quality of the designed housing amenities and utilities refer to the overall standard of the housing and to the creation of an attractive network of public spaces within the residential units.

Another important consideration is the environment within and around the development. Every design responds to its environment and vice versa. The level of the housing quality stems from the fulfilment of the basic and superior living standards within the dwelling unit, as well as the amount of complementary services, housing utilities and

**Executive Engineer (HSG-IV) & **Asstt. Executive Engineer (HSG-II), CIDCO, Mumbai*

amenities, including health, education, shopping, working, recreation, etc. The satisfaction of all human needs and desires represents a very wide range of factors, which must be taken into account and consequently incorporated in any design of living environment. The creation of mixed areas with the optimal proportion of residential units, amenities, working and public spaces facilitates the design of convenient, pleasant spaces for the largest possible spectrum of users and dwellers. Design of the residential areas must cover all standard needs of the individual and community expressive of its way of life.

Hence the terms "housing amenities" and "utilities" represent a very important part of design considerations for Mass Housing developments. Housing utilities are all the things that are necessary in order to live. Water, electricity, heating, air conditioning, kitchen equipment, furniture, balconies, terraces, garage, parking lots, etc., are what most people consider utilities when looking for a place to live. In the urban context it applies mainly for the structure of amenities of a city and the community in order to design specific areas for shops, services, offices, leisure, health and education facilities and culture. It also includes the quality of design of semi-private and public spaces.

To achieve scale and speed, mass housing was the preferred option in the decades of the 1950 to the 1970s – a period of rapid population growth and urbanization globally. Mass housing hence became a concept of housing development that was publicly funded and administered for low-income families.Such housing has been produced in many configurations including low rise, single dwelling units but more often as multi story walk-ups or high rise apartment blocks. Housing units are laid out in clusters around open spaces or in parallel rows as well as various other configurations.

The recent combination of functional and social diversity has emerged in response to the failure of large housing developments in the 1970s. In this context the planning tools have a real effect on the spatial distribution of social groups and activities. The proximity of people of different social strata promote the efficiency of services in a neighbourhood while encouraging the diversity of housing, success of local businesses, and vitalises public spaces.

ACUTE HOUSING SHORTAGE Vs UNSOLD VACANT UNITS: THE PARADOX

It is a well-documented fact that urban population in India is rising exponentially and the urban centres are facing acute housing shortage. The number is estimated to have gone beyond the 20 million mark. On the flipside, millions of housing units lie vacant and unsold. This is the paradox that exists and continues to baffle the common man. The ground reality is that the majority of these unsold units are simply unaffordable even to the middle class.

This scenario prevails in the metros as well as the Tier II and Tier III Cities. Despite growing migration to major urban centres, there exists a huge stock of houses, in the surrounding smaller cities, awaiting buyers.

Some of the probable factors responsible for the high rate of vacancy levels are:

- High Property Prices and Low Buying Capacity: Majority of the Indian population falls under the lower-middle income level, with a major chunk of their monthly income being spent on basic living expenses like food and clothing. Education and Health costs take up the rest of the surplus income, severely impacting the home purchasing capacity of an average buyer. In case of the Economically Weaker Section (EWS) and Lower Income Groups (LIG), the buying capacity is further diminished.
- Infrastructure Issues: Most of the affordable homes developed by private entities are constructed in developing areas where the land prices are low. However, many a times, such areas lack basic infrastructure and connectivity. Since the affordable category home buyers are generally end-users, such

infrastructure issues resulting in maintenance costs as well as the risen costs of the daily commute to the work places, deters people from buying these units.

- Economic Slowdown: Ever since the realty market was hit by the recession in 2013, it has been constantly reeling under the pressure of weak buyer sentiments. Across cities, prospective buyers have been waiting for price correction, political stability or rapid economic growth. Liquidity issues on the developer's end leading to prolonged project delays have also impacted the buyer's sentiments adversely.
- Other Financial Constraints: Commercial banks and other traditional means of finance for housing do not serve the low income groups, whose income may vary or is below a liable threshold. Housing finance companies are unable to serve LIG and EWS categories owing to their inability to provide required documentation for hassle-free disbursal of loans.

Other factors that dampen sales of 'affordable homes' are:

- Underdeveloped Social Infrastructure;
- Absence of dedicated transport facilities to the nearest amenities and public transport facilities;
- Limited projects from reputed builders leading to compromised construction quality.

Overall, it can be surmised that Land Prices and Construction Costs are the major factors that affect the affordability and consequently saleability of dwelling units.

So, the basic measures to ensure affordability would include

- Availability of ample land at reasonable prices for private entities and government entities playing their part in increasing the saleable housing stock;
- Special incentives like tax concessions and expediting infrastructural development in areas where affordable mass housing is being developed;
- Private entities should also use new construction technologies like Aluform and Precast so as to bring down construction costs.

Developers can also leverage on innovative and low-cost technologies such as pre-fabricated building materials, which can be used to construct mass houses quickly and cost–effectively. Although, pre-fab materials are 15-20% more expensive, developers would gain from the dual benefits of higher efficiency and lower labour costs. In Europe and the Middle East, the use of precast concrete and engineering homes technology has enabled certain developers in saving 60-70% of the total man hours needed using conventional methods.

PRESENT DAY SCENARIO

It's quite evident that India doesn't lack resources, but the need of the hour is to make them available to its population. There needs to be a reduction in cost of the available stock and the new construction needs to reflect the actual demand. Only then we can dream of fulfilling the actual aim of 'Housing for All'.

"Government policies and incentives, private initiatives and thorough cooperation and open dialogue between the two is the only way forward to 'Reimagining Mass Housing'."

REIMAGINING MASS HOUSING: HOUSING FOR ALL

Housing for all by 2022 is a bold claim by the current government but it is not as far-fetched a dream as it may sound. The Pradhan Mantri Awas Yojna (PMAY) or Housing for all (Urban) was introduced as a means to bridging the gap between the demand and supply of housing stock in the country.

As discussed in the previous paragraphs, the actual demand for housing units lies in the lower economic strata of urban dwellers (96%) and this acute shortage needs to be addressed urgently.The PMAY-HFA (U) was formally launched in June 2015 as an instrument to provide affordable housing to the urban poor. Following are the salient features as per the latest amendments in brief:

- The annual income cap has been raised to up to Rs 3 lakh (from Rs 1 lakh earlier) for EWS and Rs 3-6 lakh (from Rs 1-2 lakh earlier) for LIG;
- Minimum unit size for EWS housing: 30 sqm;
- Central assistance in the range of Rs 1 lakh- Rs 2.30 lakh per beneficiary would be provided under different components of the National Urban Housing Mission;
- The government will provide an interest subsidy of 6.5% on housing loans availed by the beneficiaries for a period of 20 years under Credit Link Subsidy Scheme(CLSS);
- The houses will be owned by females or jointly with males;
- The beneficiary should not own a pacca dwelling unit in the name of any family member in any part of India.

The Mission is being implemented during 2015-2022 and intends to provide central assistance to Urban Local Bodies (ULBs) and other implementing agencies through States/UTs for:

- In-situ Rehabilitation of existing slum dwellers using land as a resource through private participation
- Credit linked subsidy
- Affordable Housing in partnership
- Subsidy for beneficiary-led individual house construction/enhancement.

While this is an initiative worthy of appreciation, the path ahead seems mired by challenges. While area has been specified, there is no clear policy framework for EWS and LIG housing and is therefore open to interpretation. This problem is compounded by rising land costs, spiralling construction costs, and inadequate reach and availability of micro-finance measures. A long winded process of obtaining multiple approvals from different authorities in a two to three year time-frame further complicates the course of implementation. The financial institutions would be providing short term funding necessitating multiple rounds of funding for the same project, and the acquiring of land is not supported by funding at all.

All these challenges make it a very difficult task to achieve by private entities and thus limit the involvement to the select few premium entities that can finance projects of this scale while keeping the costs low enough to succeed in providing the 'affordability' that has been promised.

High urbanisation rate, coupled with rapid migration from rural areas demands an alternative solution. This is where the contribution of government development authorities comes in. Government owned land can solve the issue of rising land prices. Public-Private Partnerships could ensure development of housing stock that reflects the needs of the users and is not just 30 sqm unit fraught with infrastructure and other problems. Involvement of government entities can streamline the process of acquiring funding as well as obtaining approvals.

One such example is the announcement by MHADA (Maharashtra Housing and Area Development Authority) in newspaper called DNA. As per the announcement, MHADA plans to partner with private developers and land owners to construct 20 lakh housing units by 2020. As per their proposal, individual or corporate land owners with a minimum of 10 acres of unencumbered land, with the title in their name and free from all encroachments, liens, mortgages, leases and litigations, can approach MHADA to participate in development of affordable housing projects on a Joint Venture basis.

While the private partner will bear the cost

of land, MHADA plans to bear the complete cost of construction, infrastructure development, marketing costs and project management and administrative costs. Both parties would open separate escrow accounts which would be credited with receipts from the project and would have to arrive at a consensus about the price too. The projects would cater to Low Income Group houses with at least 35 percent units reserved for the Economically Weaker Sections and the allotment would be based either on first-come, first-serve basis or by lottery.

An ambitious initiative by CIDCO aims to make affordable housing a reality in the near future. The State Level Sanctioning-cum-Monitoring Committee (SLSMC) has recently approved a major proposal that would enable CIDCO to execute Mass Housing Projects in various nodes catering to the EWS and LIG sections. This is a huge undertaking that will make more than 15000 affordable houses available in various nodes out of which 35% would be under third provision of PMAY (U) wherein the Central Government intends to provide assistance in order to develop Affordable housing in partnership with the Developing Authority.

Salient Features of the Proposal are as follows:

- The proposal aims to provide a compact 1 BHK unit for the EWS with a carpet area as per PMAY (U) along with all the basic amenities like water supply, sewerage, storm water drains, external electrification (by MSEDC Ltd.), solid waste management and approach roads etc.
- The EWS units may receive subsidies amounting to Rs 1.5 Lakhs from Central Government and Rs 1 Lakh from the State Government.
- In addition, the Developing Authority may be providing a subsidy in land cost.
- Allotment of tenements would be done as per reservations specified in PMAY (U).

The scheme has been approved by the state level committees and they have recommended the Mission Director to submit the same to the Ministry of Housing and Urban Affairs so as to obtain approval from the Central Sanctioning and Monitoring Committee.

CONCLUSION

Cities are a product of the direction the urbanization takes. While it is important that mass housing projects should cater to the needs of the user, it is important to understand a wider aspect. Large projects, such as these, shape our cities. Therefore the conceptualisation and execution of such projects must ensure that these projects utilise the resources available in the city to the fullest, and in turn, enrich the built and social environment of the area too.

Many developmental policies have been shaped with this aim in the past and have met with mixed results. Analysing and understanding the various issues that led to past failures has resulted in a new Rental Housing Scheme that has been launched keeping all these various factors in mind.

The latest version of the Rental Housing Scheme places a greater emphasis on the connectivity of the rental housing properties with the rest of the Mumbai unlike the previous scheme which was focused on creating such units in the outskirts. In addition, livelihood opportunities and other basic civic and social amenities have also been taken into consideration. Moreover, the latest proposals provide relatively higher incentives to the developers in terms of higher FSI and a proportion of area for sale in certain cases.

However, most experts feel that these added incentives would not be enough to make the policy a success. As per articles in various National Publications, experts working in major private builder houses feel the following measures are prerequisites so as to ensure the success of the scheme:

- Ensure single-window clearance is implemented so as to optimize time and costs;

- Provide clarity on the responsibility of providing infrastructure;
- Financial incentives such as lowering interest rates, and providing tax exemptions would provide developers the push to operate in the affordable rental segment that typically has low margins;
- The key factors including mass transportation services, connectivity to CBDs or other work places must be taken care of.

Another possible method to ensure proper implementation would obviously involve government entities to be a part of the implementation bodies.

An actual project was analysed to check the economic feasibility of the scheme based on the concept of Space Sharing Model, by grant of additional FSI so as to create affordable housing stock. As per this, one-third of the total permissible FSI could be used by the Implementing Authority as the Free Sale Component.

To practically analyse the feasibility of the scheme we did an actual cost analysis and discovered that as per the current scheme in order to make the project viable we would have to sell the Free Sale Component more than 30% costlier than our current market price for other similar units.This concludes with certainty that the current scheme is not viable. As per our calculations, the Free Sale Component should be around 50%, so as to cover for project exigencies and ensure the successful implementation of the scheme.

The study has been submitted for further consideration and is just a small effort, on the part of our organisation, at making the city of our dreams. A city that responds to its dwellers and visitors alike, a city that is a home to all.

SLUM DEVELOPMENT AND REHABILITATION – THE NEED OF THE HOUR

A.K. Srivastava* and Angshukana Datta**

Abstract

This paper aims to figure out various slum development and rehabilitation techniques for enabling urban conditions and slum upgrading, in an inclusive and integrated manner, that will contribute in reducing social inequalities and strengthen drive towards sustainable urbanization in developing economies like our country.

The paper also aims to figure out the various challenges in the urban sector. The upcoming solutions to the urban problems have been explored henceforth. The Urban Theory and various types of Urban Zoning have been discussed in this paper. The study is based on the Slum Development and Rehabilitation giving focus to the slum and squatter settlements. The different models and government schemes under Slum Development have been considered for the study. The findings from various case studies on Resettlement and Rehabilitation of the Urban Poor has been included subsequently. The paper also aims to cover the aspects of upcoming new technologies in improving the conditions of slum dwellers and rehabilitators. The paper concludes with the observations and recommendations in slum upgrading and the future aspects for developing informal settlements in our country.

INTRODUCTION

The towns and cities grow in size and number as the urban population expands. According to the Census of India 2011 it is revealed that the urban population of our country stood at 377.1million which is approximately 31 per cent of the total population. With this situation, the present infrastructure and amenities in cities and towns are not adequate to address the expanding urbanization process.

The principal cause of urbanization in India as in other countries is the growth of modern type industry, commerce and service occupations all of which are concentrated in urban areas, and especially in the cities. During the last decade, these factors have accelerated the movement of population to urban areas and especially to the cities.

Several initiatives were launched by the government to promote urban infrastructure in the country. The three major urban development initiatives launched are the: Smart Cities Mission; AMRUT (Atal Mission for Rejuvenation and Urban Transformation) and Pradhan Mantri Awas Yojana (Urban) or Housing for All by 2022 Mission.

URBAN GROWTH THEORY AND URBAN ZONING

Urban growth theories explain the internal demographic, spatial, and economic growth of cities. These three features of a city's growth are not entirely separable. However all these factors are interlinked with each other.These growth theories form the dynamics of internal growth for enhancing the richness of the city.

Zoning is the process of dividing land in a municipality into zones (e.g. residential, industrial) in which certain land uses are permitted or prohibited. The type of zone determines whether planning

*Senior Vice President, ICT Pvt. Ltd., New Delhi & **Deputy Manager, ICT Pvt. Ltd., New Delhi

permission for a given development is granted. Zoning may specify a variety of outright and conditional uses of land. These guidelines are helpful to review and compare current planning regulations (especially densities, floor space prescriptions) in selected cities of different sizes and examine its appropriateness to include low income affordable housing and regularized slum/ resettled slum for urban growth and development.

CHALLENGES IN THE URBAN SECTOR

India is poised to have nearly fifty percent of its population living in urban areas in the next decade which poses a challenge for the urban development and renewal task. Presently, 31 per cent of India's population is living in urban areas, which rose by 3.35 per cent between 2001 and 2011 and 2.10 per cent between 1991 and 2001. By next 20 years, this population is projected to rise by over 200 million bringing up challenges related to land-use and expanding infrastructure development to new cities and metropolises.

With India's burgeoning population, the issue of increasing urban poor and providing basic amenities like sanitation, water supply, affordable housing and public transport remains a huge challenge in the urban areas.

SLUM AND SQUATTER SETTLEMENTS

Slum is a compact settlement of at least 20 households with a collection of poorly built tenements, mostly of temporary nature, crowded together usually with inadequate sanitary and drinking water facilities in unhygienic conditions.Slums are highly congested urban areas marked by deteriorated, unsanitary buildings, poverty, and social disorganization.

Squatters settle on land, especially public or unoccupied land, without right or title. Squatters include those who settle on public land under regulation by the government, in order to get title to it. In other words slums refer to the environmental aspects of the area where a community resides, while squatters refer to the legality of the land ownership and other infrastructure provision.

SLUM DEVELOPMENT AND REHABILITATION

Slums have constituted as an integral part of cityscape for several decades. With its potential to provide employment to a vast multitude, the city attracts a large number of people. Due to the change in agricultural scenario, no prospects in rural areas, bigger opportunities in cities preference on labor market than agriculture many of them stay in slum colonies for the lack of a better alternative.

Slum-dwellers stay in shanty structures in unhygienic environment, not by choice but by compelling circumstances as they were thrown out of the formal housing sector, the latter being expensive and much beyond their income levels. It is imperative to enhance their standard of living and for which an authorized dwelling unit is a first step in the right direction. This, in turn, will bring about a marked improvement in their hygiene and health as well as raise the level of public hygiene which has fallen to very low ebb.

GOVERNMENT INITIATIVES FOR SLUM DEVELOPMENT

a) Pradhan Mantri Awas Yojana (Urban) or Housing for All by 2022 Mission proposed to be implemented during 2015-2022 aims to provide housing to all urban people by 2022. It provides central assistance to States and UTs for constructing houses to all eligible sections by concentrating on urban slums and economically weaker sections. Hence, slum rehabilitation and affordable housing to Economically Weaker Sections are the major features of the project.

The mission covers the following components

- Slum rehabilitation of Slum Dwellers with participation of private developers using land as a resource;
- Promotion of Affordable Housing for weaker sections through credit linked subsidy;
- Affordable housing in partnership with Public and Private sectors and
- Subsidy for beneficiary-led individual house construction or enhancement.

b) Valmiki Ambedkar Awas Yojana (VAMBAY) was launched in December 2001 which was a centrally sponsored scheme with an in-built subsidy for undertaking construction of dwelling units for slum dwellers.

c) Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched on 2005 with the objectives of augmenting infrastructure facilities in cities and towns along with provision of shelter and basic civic services to slum dwellers/urban poor. JNNURM aims at creating 'economically productive, efficient, equitable and responsive Cities' by a strategy of upgrading the social and economic infrastructure in cities, provision of Basic Services to Urban Poor and wide-ranging urban sector reforms to strengthen municipal governance.

d) Swarna Jayanti Shahari Rozgar Yojana (SJSRY) aimed at providing gainful employment to the urban unemployed and under-employed poor, through encouraging the setting up of self-employment ventures by the urban poor living below the poverty line, skills training and also through providing wage employment by utilizing their labour for construction of socially and economically useful public assets.

e) Integrated Low Cost Sanitation (ILCS) This scheme envisages the conversion of dry latrines into water seal twin-pit sanitary latrines on a whole town basis.

f) Affordable Housing in Partnership (AHP) It seeks to promote various kinds of public-private partnerships -government with the private sector, the cooperative sector, the financial services sector, the state parastatals, urban local bodies, etc to create affordable housing stock.

g) Rajiv Awas Yojana (RAY) has been launched in 2011. RAY for the slum dwellers and the urban poor envisages a 'Slum-free India' through encouraging States/Union Territories to tackle the problem of slums in a definitive manner.

FINDINGS FROM CASE STUDIES

- The increase in slum population (Fig.1&2) is due to migration from the other states for better employment opportunities.
- The increase in cost of housing in the city and poor affordability has resulted in slum growth.
- The socio-economic conditions and physical infrastructure i.e. water supply and sanitation is in vulnerable conditions in the slum.
- Slum dwellers are not aware about the various government schemes and programmes.
- There is lack of health care facilities and educational institutes in the slum area.

Fig. 1 Slums

- Due to deprivation of basic amenities and community participation slum dwellers are dragged into social tensions in the society.

NEW TECHNOLOGIES FOR SLUM DWELLERS AND REHABILITATORS

There are New Technologies have been proposed for improving the conditions of Slum dwellers and rehabilitators. A Technology Sub-Mission external link under the Mission has been set up to facilitate adoption of modern, innovative and green technologies and building material for faster and quality construction of houses. Technology Sub-Mission also facilitates preparation and adoption of layout designs and building plans suitable for various geo-climatic zones. It will also assist States/Cities in deploying disaster resistant and environment friendly technologies.

The Slum Rehabilitation Authority (SRA), in India enables property developers to rehabilitate slum-dwellers in-situ and compensates the landowner and developer by awarding them with the Transferable Development Rights (TDR). Slum Rehabilitation Authority (SRA) in Maharashtra has brought forth a Slum Rehabilitation Programme that analyzes and reviews existing positions of slum areas in the city. The SRA then devises plans for rehabilitation of these identified slum areas and ensures that the slum rehabilitation scheme planned is executed to the best of SRA abilities.The new housing follows a high-rise building design using optimal ground footprint and frees up land for commercial building and other development. The SRA model is a financially sustainable model, which requires no government funding and gives new homes to slum dwellers free of cost.

Fig. 2 Slums

RECOMMENDATIONS

- The concept of Slum upgrading should be accomplished through extending land, services and amenities to slum dwellers.
- Slum dwellers through their association or other suitable means should be consulted while formulating redevelopment projects especially for the purpose of designing of slum rehabilitation component.
- Land for housing the poor is not considered as a critical issue for the society and therefore this issue must be prioritized.
- Limited impact of government schemes for the urban poor is another bottleneck in this sector.
- Multi-pronged and fast paced housing efforts need support for rapid socio economic development of urban poor.

- Encourage volunteers to create awareness about various slum upgrading and rehabilitation programmes and schemes among slum dwellers.
- Changing the mindset of the people should be given primacy in our country for slum development and future progress.

CONCLUSION

Slum population makes positive contribution to the city's economy by active participation in productive activities. Squatter settlements in urban areas are inevitable phenomena. As long as urban areas offer economies of scale and agglomeration economies, large cities will always continue to grow attracting migrants from rural and smaller urban areas, leading to more squatting. There are no readymade solutions that can solve the problems of squatting in all parts of the developing world. Therefore considering the inevitability of squatting, the need is primarily for a change in attitude towards squatting, squatters and squatter settlements. The "enabling" approach by various government and public authorities where instead of taking a confrontationist attitude, governments will strive to create an enabling environment, under which people, using and generating their own resources, could find unique local solutions for their housing and shelter problems. This will impart a feasible solution for slum development and will provide services and amenities to the urban poor which will be a critical development of urban areas in our country.

Way Forward

At the slum decadal growth rate of 34%, the slum households are projected to go upto 18 million. Hence slum rehabilitation and slum upgrading projects must be formulated, approved and implemented faster for developing informal settlements in our country. Slum policies and programs so far have not served the urban poor as the main beneficiaries. We need to formulate and implement slum policies for effective 'slum upgrading best practices' in India.

Another factor is that planning policies and housing developments are not keeping pace with population growth. With large scale urbanization we need to plan and develop urban areas in a systematic manner, invest in infrastructure and improve the quality of life in our cities.

The target of Housing for All by 2022, by providing adequate and decent housing for all can be achieved if a paradigm shift takes place where Government and other public authorities need to approach urban dwellers as primary actors of their own housing developments and key tenets of slum upgrading and enabling approaches. There is an urgent need to address the downside of proliferating slums, increasing homelessness, growing urban poverty and crime, of relentless march of pollution and ecological damage.

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PRADHAN MANTRI AWAS YOJANA : NEED FOR COURSE CORRECTION

A.K. JAIN*

Abstract

PMAY launched in June 2015 aims to build 20 million houses by 2022. However, only 41,000 houses were built till-March 2017, and 16.3 lakh houses had been sanctioned. This rings an alarm and calls for revisiting PMAY. The paper identifies certain areas of PMAY, which need to be revisited. The current emphasis of social housing is on green field development and supply driven with private sector partnership. This may endanger the access of housing for the poor which may be bought out by the investors. This need developing a new paradigm, which is community led, participatory and local. As a rule, at least one-fourth of housing is built/developed by individual plot owners, one-fourth by cooperatives/ slum communities, one-fourth by government/local body and one-fourth by the private sector/PPP.

A criticism of PMAY pertains to sizes of EWS and LIG houses, which do not match with the socio-economic growth. It is feared that the construction of 30 sqm houses may lead to creation of pigeon holes and trigger illegal extensions.

Out of total housing shortage of 18.78 million, 14.99 million dwelling units comprise dilapidated and congested houses. As such, about 80 per cent of the housing stock involves urban renewal, upgradation, regularization, redevelopment, rehabilitation and retrofitting.

A significant percentage of the weaker/ lower income group can't afford housing on ownership basis. Rental housing has been an important instrument for provision of housing at affordable price to general public, working women, low wage casual labor and employees, migrants, students and young professionals. For a city, rental housing to the extent of one-third to one-half number of total units should be mandatory.

For augmenting the physical infrastructure, it is vital to promote 'area-wise' decentralised services for water, sewerage and solid waste management. To make social housing schemes bankable, it is necessary to optimise utilisation of land by higher density and FAR, besides reducing the cost and time in land development, construction and infrastructure provision. Subsidies, financial loans and mandatory reservation of land, low cost construction and community driven housing development can be the critical tools in achieving Housing for All by 2022

INTRODUCTION

India's urban housing shortage is estimated at 18.78 million, 95 per cent of which is for the Economically Weaker Sections (EWS) and Lower Income Group (LIG). The 2011 Census found that nearly 65.5 million people (13.9 million households) reside in slums. The Government of India under the Pradhan Mantri Awaas Yojana (PMAY) aims to provide housing for all by 2022 and build 20 million houses for the urban poor. PMAY covers all 4041 statutory towns while focusing on 500 Class I cities in initial phases.The PMAY stipulates dwelling unit size of 30 sm. (carpet area) for EWS households and up to 60 smfor the LIG. The household income ceiling for EWS and LIG categories isRs. 3 lakh and Rs. 6 lakh per annum respectively.

**Former Commissioner DDA, Member MOUD Committee on DDA, Member GNCTD Committee on Delhi Vision 2030 .*

However, against the target of building 20 million houses by August 2022, only 41,000 houses were built till-March 2017, and 16.3 lakh houses were sanctioned. This presents an alarming situation and the flagship PMAY needs to be revisited in order to achieve the target.

Housing is a State subject which involvesclose coordination among the Central, State and Local Governments and entails cross-sectoral coalition of social, economic, environmental and governance systems. This requires the following:

- Partnerships and community participation
- Access to land
- Housing norms
- Regulatory and planning controls/clearances
- Housing and upgradation and renewal
- Provision of rental housing
- Infrastructure services, outsourcing process and construction technology
- Financial resources, loans and subsidies

PARTNERSHIPS AND COMMUNITY PARTICIPATION

The current emphasis of social housing development is generally on green field development and is supply driven with private sector partnership. This may endanger the access of housing for the EWS and LIG which may be bought out by the investors/ speculators for whom housing is a commodity. As a result, a large number of new dwelling units built in PPP mode remain unoccupied. The paradox is that as many as 11.09 million houses are lying vacant in urban areas (Census 2011), on the face of the total housing shortage of 18.78 million dwelling units.

This poses a need to re-examine the supply driven approach towards housing. The public -private model is focused on greenfield development and largely caters to MIG and HIG. There are few exceptions where PPP model in social housing have succeeded. One such project is Sukhobrishti at Rajarhat, Kolkata. (Fig.1) This project was developed by Shapoorji Pallonji in association with the KMDA and West Bengal Housing Infrastructure Development Corporation (WBHIDCO). The project covers 150 acres of land in Rajarhat and has 20,000 dwelling units: 10,444 (LIG)apartment with carpet areaof 320 sq.ft., 3840 MIG apartments of 480 sq. ft. and balance 5716 apartments having an area of 690sq.ft.

Fig. 1: Shukhobrishti at Rajarahat New Town, Kolkata

This needs developing a new paradigm, which is community led, participatory and local and is based on the principle of equitable allocation of resources, space and land. The aim is to create inclusive housing which provides everyone with a house with linkages, livelihoods, water, electricity, toilets and security. This makes us to rethink about the model of public-private binary and evolve a third option.

The following are the basic ingredients of the third option:

- Community as the core actor in the shelter process
- Demand –driven approach rather than supply-driven
- Local communities control the money and resources

- Promote a broader concept of upgrading and improvement of existing shelters
- Promote variations rather than standard solutions
- Synchronize shelter and poverty reduction
- Optimum utilization of urban land with focus on brownfields
- Capacity development, community empowerment and new partnerships.

The third option does not exclude public or private sectors. They participate and energise the community sector.

LAND

According to the Town and Country Planning Organisation (TCPO) estimates to meet the current housing shortage in the form of group housing on average density norms, 84,724 Hectares to 1,20,882 Hectares of additional land would be required. Land is the basic platform for housing and other activities. However, the acquisition of private lands has become extremely difficult under the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013. A GIS based inventory and total station survey of all potential lands suitable for housing, redevelopment and resettlement should be prepared. Land parcels currently in government possession or unused lands in the SEZs, etc. can be explored for housing development. Digitised land inventory can release substantial public land for new housing and redevelopment.

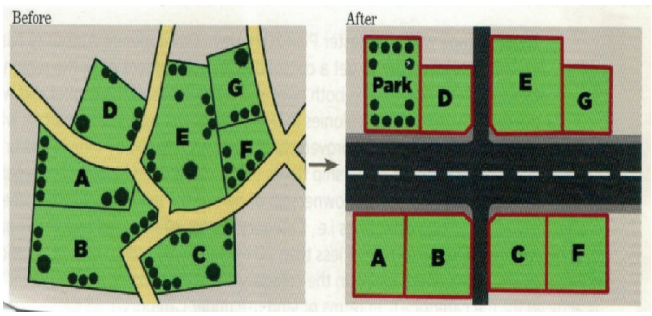

Fig. 2: Land Pooling as an Alternative to Land Acquisition

Land is the most expensive component of housing. If land cost is excluded, social housing becomes affordable and viable. This implies mandatory reservation of land for EWS/LIG in all housing projects, the cost which is excluded from the cost of the house.

Compulsory reservation of land for social housing and new options of access to land such as land pooling, Transferable Development Right (TDR), land banking, partial market sale housing, mixed land use and joint development can be adopted.

The challenge of land tenure and transfer of ownership of government lands under slum clusters and illegal colonies is a major issue and a determinant of its planning and development. This needs to be reviewed with reformed procedures of ownership/ tenure rights so that the poor become the legitimate owners. This will encourage legitimate approval of the layout plans and building plans, facilitating a gradual conversion of informal/illegal settlements into planned areas. In slum areas rental tenancy can be recognised. For the promotion of collective community development, land can be jointly owned by all the residents. (Fig.2)

HOUSING NORMS

A criticism of PMAY pertains to prescribed sizes of EWS and LIG houses, which do not match with the Indian economy growing at +7%. According to Yojana Ayog, in next fifteen years every house will be air-conditioned. The minimum housing in most of the poor countries varies between 40 to 60 sqm plinth area. Even in early fifties, the Prime Minister Jawahar Lal Nehru stipulated that the house should have minimum two rooms. A house is a life long procurement of a family. While the family and its income grow, if the house is static, it may lead to unauthorized addition/alterations and fragmentation of the families. It is feared that the construction of 30 sqm houses may lead to creation of pigeon holes and soon may be obsolete. It is necessary that minimum housing standards may be reviewed, which are in consonance with the socio-economic growth. Moreover, the definition of housing should

include hostels and dormitories for men and women, night shelter, etc.

REGULATORY AND PLANNING CONTROLS AND CLEARANCES

Planning norms, land use, zoning, density, FAR, and building controls need to be framed or reviewed so that these facilitate optimum utilization of land. A fixed density and FAR could lead to under-utilisation of land potential and imposition of artificial limits to optimal use of scarce urban land. To make in-situ slum rehabilitation feasible by retrieving the encroached land, part of it can be used for public facilities, utilities and green reservations.

Effective management and maintenance of social housing schemes involves regulations, systems and partnership through the following measures:

- Creating awareness among the communities and involving them as partners with the preparation of Community Action Plan (CAP).
- Contracting out the maintenance of physical and social infrastructure services
- Working out a systematic maintenance cycle (daily, weekly, monthly, etc).

The Real Estate (Regulation and Development) Act, 2016 provides for creating a Real Estate Regulatory Authority and an Appellate Tribunal that will act as the watchdogs for the housing sector and to protect the consumer interests. The Act requires greater disclosure from the developer, project accountability and removing the information asymmetries from the housing market. The Act mandates the compulsory registration of real estate agents, so as to provide protection to buyers, while also preventing money laundering by the non-organised broker community. A major provision of the Act is the standardisation of area measurement, with carpet area to be the measure. Developer would need to provide the status of all approvals as well as sanctioned plans to buyers and will not be able to sell their project without obtaining the required approvals. The Act also seeks to ensure that the buyer's payment is utilised for the development of the particular project by creation of an escrow account, where 70% of the customer advance will be used only for that project. The developer has to adhere to the timelines and other conditions of the project. To bring in accountability in real estate sector, rating of developers and projects and licensing of real estate agents/brokers/realtors need to be implemented.

To obviate the risk of delays and cost over-runs in execution, the housing agency should be capable of crossing the administrative, procedural and financial barriers. Special Purpose Vehicle may have to be created for this task.

In order to streamline the housing transactions, as well as to discourage encroachments on public land, it is necessary to make property registration, mutation and transfer simple, transparent and quick. The city-wide Spatial Data Infrastructure should be mandatory for all urban areas. Vertical ownership of independent floors/flats and the concept of air-rights should be adopted. Computerization of land records and property registration will help in creating a transparent property market. To deal with the problem of property titling, it is necessary to introduce Torrens System of property title certification by the government, which would avoid litigations on the question of property titles.

The single factor which can derail the mission of building twenty million housing by 2022 could be the regulatory regime of building bye-laws. Even if all the resources-land, finances, technology, building materials, manpower and machinery are made available, the delivery of houses can be delayed, unless the development control regulations and building regulations are reformed. Model building bye-laws have been formulated by the Ministry of Urban Development mandate online Building Plan approvals on single platform.

Often due to the disputed land ownership, non-approval of building plans of existing buildings and lack of an approved layout plan, the ULB does not find it possible to approve the redevelopment plans

and building plans. This requires certain exemptions from the existing building bye-laws which should focus more at the cluster level, whereby the owners come together and reorganize their individual properties so as to provide minimum roads, common green, soft parking and common facilities. The amalgamation and reconstitution of the individual plots may be permitted and incentivized with an extra FAR and density. The standards of minimum width of roads and community facilities can be relaxed, wherever justified by planning considerations.

HOUSING UPGRADATION AND RENEWAL

Out of total housing shortage of 18.78 million, 14.99 million dwelling units comprise dilapidated and congested houses. As such, about 80 per cent of the total housing to be built under Pradhan Mantri Awas Yojana (PMAY) involves urban renewal, upgradation, regularization, redevelopment, rehabilitation and retrofitting.About 20 to 30% of the population in major cities in India resides in unauthorised colonies. These are often built on public lands and lack basic services, open space and facilities. As the buildings are built without any approval many of them are unsafe and dangerous.

As such rather than greenfield development, it is necessary to focus on upgradation and redevelopment of old, dilapidated housing areas, urbanized villages and irregular colonies. This needs framing up comprehensive guidelines for the redevelopment, which promote affordable housing (both rental and ownership), and discourage speculative property development.

In-situ slum rehabilitation by using land as a resource is an important component of the Housing for All mission (Fig.3). Additional Floor Area Ratio (FAR)/Floor Space Index (FSI) can make slum redevelopment projects financially viable.Slum rehabilitation projects can have a free sale component for market sale so as to cross subsidize the project. The free sale component of the project should not excess 40% of the FAR and is to be disposed of before completion and transfer of slum rehabilitation component. The viability of slum redevelopment project can be supplemented by the grants from the Central Government and State Governments.

The identification of built-up housing areas for regularization, redevelopment, rehabilitation and resettlement of unplanned areas including unauthorized colonies can be decided based on the basis of a Multiple Index System.

The Development Controls, including incentive FAR and densities, should be worked out on the basis of a Housing for All Plan of Action of the city. The increase in FAR and density should synchronize with enhanced greens/open spaces, social/community facilities, infrastructure services, parking, etc. The concept of "accommodation reservation", i.e. allowing incentive FAR to land owner against the provision of community facilities in private plots, can be invoked for built-up area and regularized unauthorised colonies. In this way the community facility would be made available free of cost and without putting burden on the urban local body. Mixed use, additional FAR and commercial activity in part of the plot can be allowed against appropriation of land for public purpose.

The following are the pre-requisites for conversion of plots into flats:

- Computerised Land Record/GIS/SDI
- Special Regulations- DCR/BBL
- Exemption from submission of old Approved Building Plans
- Exemption from land ownership, All occupants should have right to scheme
- Online Building Plan Approval
- Higher FAR and Densities
- Transit Accommodation
- Facilitate the formation of small community cooperatives/groups

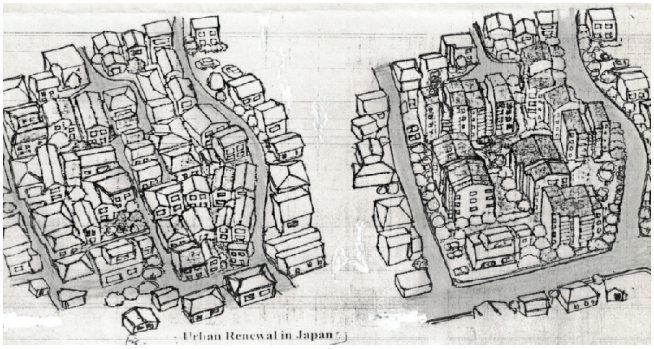

Fig. 3: From Plot (Low-rise) to Flats (High-rise), and from Unplanned Growth to Planned Development

PROVISION OF RENTAL HOUSING

A significant percentage of the weaker section and lower income group can't afford housing on ownership basis, even when such housing is subsidized. Rental housing has been an important instrument for provision of housing at affordable price to general public, working women, low wage casual labor and employees, migrants, students and young professionals.

Rental Housing projects can be facilitated by creating Special Purpose Vehicles (SPVs) offering loans on lower interest rates and by allocation of certain percentage of funds especially for social rental housing. Banks and Housing Finance Institutions (HFIs) can promote innovative financial instruments.

The following can be the key triggers for rental housing:

- Draft National Urban Rental Housing Policy, 2017 needs to be more closely integrated with the Pradhan Mantri Awaas Yojana.
- For a city-wide spread of EWS/ LIG housing, provision of one-third to one-half number of rental units have to be mandatory in all housing schemes. These housing units shall be handed over to the government against reimbursement of cost of construction.
- Bonus FAR/ FSI can incentivize the development of rental housing
- Schemes such as Rental Housing Vouchers and Low-Income Housing Tax Credit of the US, which give rebate in income tax against investment in low income rental housing, can have a multiplier effect in the creation of rental housing.
- Non-profit associations may manage and maintain such properties.

INFRASTRUCTURE SERVICES AND OUTSOURCING PROCESS AND CONSTRUCTION TECHNOLOGY

A critical concern in redevelopment, redensification and slum rehabilitation projects relates to infrastructure services such as is water supply,sewerage, power and other services, which are under severe stress. These require strategic interventions, such as given below:

- Preparation of Services Plan of redevelopment, slum rehabilitation, social housing and regularisation projects
- Mandatory adoption of waste water recycling and renewable energy, water conservation, energy efficiency as per ECBC and Green Building Code, which can save 10 to 15 % of water and energy.
- Checking of leakages, thefts and transmission losses which can save about 15 to 20 % of water and power
- Enhancing organisational efficiency.

For augmenting the physical infrastructure, it is vital to work out a phased and evolutionary programs and plans of facilities and services, which allow improvements at a later date. The introduction of decentralised system of sewerage, water treatment, power generation, waste recycling and spatial characteristics of infrastructure including the cost of installation, maintenance and distribution system should be the determinants in the mode of aggregation of the housing redevelopment. It is necessary to promote 'area-wise' decentralised services for water treatment, sewerage and solid waste management. Such systems can be installed

and managed by the local communities themselves.

An industrial approach can convert housing construction into housing production, saving both cost and time. Proven technologies and regulatory support can enable large-scale, low-cost housing production. Industrial approaches (using components manufactured off-site), standardization, and improved purchasing and other processes can reduce the construction time by one-third.

FINANCIAL RESOURCES, LOANS AND SUBSIDIES

Housing finance is a long-term investment and asset liability mismatch is a major problem for housing finance. The financing of the social housing besides government grants and private sector funds can be supplemented by mortgage guarantee fund, social housing fund, micro-financing, land-housing-infrastructure bundling, Mutual Fund, Provident, Insurance and Pension Funds, General Obligation Bonds, etc.

Access to long-term funds from Provident, Insurance and Pension funds, will ease the situation. Real Estate Mutual Fund (REMF) approved by SEBI can boost supply of fund to housing sector. National Housing Bank should be allowed to raise funds through capital gain bonds. The banking industry and the HFCs can address the needs of poor sections by subsidizing interest rates, pooling funds and relaxing mortgage requirements as also through instruments such as micro-financing, community pool funding, land mortgaging, and annual installments for loan repayment. The GST for Stamp Duty would avoid repeated taxation. It is also necessary to review the cost ceilings of LIG and EWS and slum resettlement housing, taking into account the cost of land component.

To make social housing schemes bankable, it is necessary to take advantage of mandatory reservations, optimise utilisation of land by higher density and FAR, besides reducing the cost and time in land development, construction and infrastructure provision.

In the recent, the housing output of the government sector has been diminishing, which is progressively moving towards market led production. This is resulting in non-affordable housing, monopolies and profit oriented market, besides lack of a sense of ownership. In order to create a competitive housing market, it is necessary that as a rule at least one-fourth of housing is built/ developed by individual plot owners, one-fourth by cooperatives/ slum community, one-fourth by government/local body and one-fourth by the private sector/PPP. Usually in the PPP projects a component of land is allowed for commercial use and market sale by the developer to compensate and finance the development of social housing, including public utilities/greens or infrastructure.

According to McKinsey Global Institute, the following three main factors can help in making the investment in affordable housing financially viable:

i) Reduce Loan Origination costs:

- Improve assessment methods to quality borrowers.
- Introduced standardized property valuation methods
- Initiate mortgage-guarantee schemes

ii) Reduce cost of funding mortgages:

- establish liquidity facilities
- Expand capital market funding (with mortgage bonds/ securities)
- Increase use of core deposits

iii) Leverage collective savings to reduce rates:

- Launch housing provident fund
- Offer contractual savings schemes

REITs and InvITs can be the alternative avenues of sourcing institutional capital. Real Estate Investment Trusts (REITs) and Infrastructure Investment Trusts (InvITs) can act as a key enabler for capital markets in real estate sector while providing

investors with exit options. Both REITs and InvITs have the potential to bring in nearly Rs. 3000 billion over the next few years. To enable the formation of REITs, the Government of India has allowed certain concessions in the tax structure of this instrument to make it more attractive for domestic as well as overseas investors.

For the consumer, it is the ultimate cost of the house that matters. To this end, besides subsidies, financial loans and mandatory reservation of land, low cost construction and community driven housing development can be the critical tools in achieving Housing for All by 2022.

CONCLUSION

A criticism of PMAY pertains to sizes of EWS and LIG houses, which do not match with the socio-economic growth. It is feared that the construction of 30 sqm houses may lead to creation of pigeon holes and trigger illegal extensions.

Out of total housing shortage of 18.78 million, 14.99 million dwelling units comprise dilapidated and congested houses. As such, about 80 per cent of the housing stock involves urban renewal, upgradation, regularization, redevelopment, rehabilitation and retrofitting.

A significant percentage of the weaker/ lower income group can't afford housing on ownership basis. Rental housing has been an important instrument for provision of housing at affordable price to general public, working women, low wage casual labor and employees, migrants, students and young professionals. For a city-wide spread of rental housing to the extent of one-third to one-half number of total units should be mandatory.

For augmenting the physical infrastructure, it is vital to promote 'area-wise' decentralised services for water, sewerage and solid waste management.

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CHALLENGES IN INDIA'S RURAL HOUSING DEVELOPMENT PROGRAMME AND ITS REMEDIES

O.P. Gupta, vsm*, Vijay Gupta**, Chandan Gupta***, Vaibhav Gupta**** and Abhishek Gupta*****

Abstract

The rural housing in India is often dominated by concerns of poverty alleviation and the effectiveness of the delivery systems of the Indira Awas Yojana, Pradhan Mantri Awas Yojana or Bharat Nirman – development programmes, aimed at securing minimum levels of pucca housing to the below poverty line population.

The average annual income of the urban Indian is 84.6 per cent higher than his rural counterpart. Rural housing lags behind urban, both in terms of the current and future scenarios. Owing to the absence of delivery mechanisms, less than 10 per cent of all housing loan applications come from villages. Most loan takers are urban folks intending to develop their rural housing.

India has made reasonable progress in recent years, especially since liberalization measures were introduced in 1991, but the rural economic growth rate has been stagnant at around 2% to 2.5% a year. The problem of inadequate housing is more acute in the rural areas where bulk of the BPL population lives. Thus, this paper will focus on the requirements of housing in rural India, present government initiatives and most importantly the technological requirements for constructing low-cost sustainable houses.

INTRODUCTION

In India, rural housing was provided through Indira Awas Yojana scheme of Govt. of India implemented in 1985, Pradhan Mantri Awas Yojana and other Govt. sponsored programmes.

India is emerging as a major power with the economy registering high growth rates. There is no uniform development, the rural hinterland not being able to match in tandem with urban India. More than seventy per cent of people live in villages. Eighty per cent of poor also live in rural areas. The benefits of economic growth are not percolating to more than two-thirds of the people.

RURAL LIVING CONDITIONS

Housing is one of the top priorities for most people, regardless of their income levels. Food, health care and education for their children. Without the security and comfort of a home, there is no escaping the difficulties resulting from poverty.

Poor people do not have the financial means to buy or construct houses with their savings, and therefore they live in their ancestral huts, those rented from landlords (with ensuing obligations), or government-supplied houses. Eighty-seven percent of homes in the villages do not have basic facilities. Cooking is usually done inside the house under inadequate ventilation with biomass such as dried cow-dung, fire wood, dry weeds or crop residue, exacerbating the risk of tuberculosis.

Rural housing has a vital role in maintaining the health and education in rural areas. Children

*Former Chief Engineer. MCD and Acting Registrar, CIAC New Delhi **GM M/s S.A. Infra Consultants ***M. D – Manya Consultancy Services, Delhi, ****Engineer, M/s S.A. Infra Consultants ***** University Student

cannot study in a poorly lit house. Respiratory disorders among rural population in India are often the result of unfavourable housing and poor living conditions. Asthma and bronchitis are caused by pollen grains, dust mites, animal waste and several environmental factors related to bad housing conditions. Poor sanitation and hygiene, inadequate ventilation and smoke inhalation are all associated aspects of poor housing that affect health and social development.

A typical Indian village has a resident population of around one thousand, while the layout of one village is different from another. Most villages are small and dense, with huts on either side of narrow lanes. Open drainage usually runs along those lanes, clogged and infested with mosquitoes. Except for those belonging to "upper castes," homes are usually placed close to each other four to five feet apart especially when the government builds housing for the poor.

A TYPICAL RURAL HOUSE

The rural poor live in huts and government-supplied "houses" that are no more than 15-20m^2 in floor area. Huts are usually constructed from mud blocks, roofs are thatched and the floors are covered with a mud and cow-dung paste that serves as a disinfectant. While the houses supplied by the government are constructed with cement blocks or bricks, the floor is cemented, and the roof is made of concrete or asbestos. Usually there is only one room in the house, but in some cases a half-wall may be built to separate out the kitchen.

SHORTAGE OF RURAL HOUSING

At the time of formulation of 12th Five Years Plan (2012-2017), Working Group on Rural Housing for the 12th Five Years Plan adapted two methodologies in assessing the Shortages of Rural Housing. In first method, the final estimated housing shortage was 43.1 million in 2012 and 43.67 million in 2017 (Table 1).

Table 1: Rural Housing Shortage

Equation no.	Factors taken into account for assessing housing shortage	Computation	Shortage (in millions)
A	Number of households not having houses in 2012	No. of households – existing stock of houses (in numbers)	4.1
B	Number of temporary (katcha) houses in 2012	Existing stock of houses – number of permanent (pucca) and semi-permanent (semi-pucca) houses	20.2
C	Shortage due to congestion, 2012	6.5 per cent of number of households in 2012	11.3
D	Shortage due to obsolescence, 2012	4.3 per cent of number of households in 2012	7.5
T1	Total rural housing shortage, 2012	A+B+C+D	43.1
E	Additional housing shortage arising between 2012 and 2017	Increase in number of households between 2012 and 2017 – increase in stock of houses between 2012 and 2017	0.5
T2	Total rural housing shortage, 2017	T1+E	43.6

Source: Working Group on Rural Housing for the Twelfth Five Year Plan, MoRD (2011)

Note: All numbers for 2012 were projections based on intercensal growth rates between the Censuses of 1991 and 2001

Whereas second method was based on estimates of the housing shortage at the end of the Eleventh Five-Year Plan, adding up the additional housing requirement due to shortage, obsolescence, and congestion, and subtracting from that number, the number of houses constructed during the Eleventh Five Year Plan. The housing shortage was estimated to be 48.8 million in 2012 (MoRD 2011, P. 9). In view of the two methodologies adopted, the working group estimated that the shortage of housing in rural India was of about 43 million housing units.

EFFECTIVENESS OF DELIVERY SYSTEM OF HOUSING

For effectiveness of delivery system in housing and its adaptabilities it is desirable that :

- The key stake holders come up with ideas that can develop an effective distribution system for rural housing.
- There is a need to stop ignoring the human resource factor in housing development in rural India. While there is abundance of supply of unskilled labour, skilled labour is always in short supply.
- There is a need to factor the issue of sanitation in rural housing.
- There is a need that rural societies and their particular cultures should be protected.
- The urban India should not impose its standards of perfect house-building on rural India.
- There is a need to provide adequate land for fulfilling the housing requirements of rural India, for which states are required to take initiative, because land issues are often left to the states.
- The subsidy schemes as they are now implemented do not address the whole problem of rural housing. Knowledge and know-how of rural conditions for housing are missing in such subsidy schemes.
- There is a need for clarifying the role of village panchayat bodies in rural housing.
- There is a need for finding solutions that are sustainable.
- There is no single solution to the complex issue of rural housing, while housing finance is a key instrument in moving towards a solution.

12TH FIVE YEARS PLAN VISION FOR RURAL HOUSING

To meet the shortage of Rural Housing, 12th Five Years Plan made a Vision for Rural Housing, for India as under: -

"Ensure adequate and affordable housing for all and facilitate development of sustainable and inclusive habitats in rural areas by expanding government support, promoting community participation, self-help and public-private partnership within the framework of Panchayati Raj."

It further stress "the need for safe and sustainable housing by all segments of the rural population."

Reasons for Failure of Housing Programme

Despite the allocation of considerable funds by central and state governments, the housing program for the poor is failing for a number of reasons, as follows:

- ill-conceived,
- Opposed to improving living conditions, and
- Executed without sufficient thought
- While the government is the main promoter of housing schemes, several non-governmental organizations (NGOs) and social entrepreneurship ventures have also

entered the arena. NGOs have to rely on donor funds that are hard to come by and therefore their contribution has not been significant.

- Social entrepreneurs who expect a certain return on their investment are focusing on lower-middle-class customers.
- Homes are built without considering the size of the family. The average floor space of 38 sq. ft per individual, not including the space taken by cattle, creates a very unhealthy and uncomfortable indoor environment.
- The focus on offering houses as "shelters" has motivated the government to look for cheap construction without offering even basic necessities.
- Government housing perpetuates the centuries-old practice of separation of residences based on caste.

SYSTEMATIC APPROACH TO ACHIEVE THE RURAL HOUSING TARGETS

Following Measures are recommended for achieving the Rural Housing targets: -

- Identification of existing and potential partners for integrated rural habitats.
- Development of technical, financing and institutional delivery models to strengthen enterprise-based environment for improved rural habitats.
- Demonstration of viable enterprises, financing models and institutional systems of delivery.
- Enhancing the financial viability of the services provided, through building enterprises around integrated habitat development rather than the usual sectoral approach of housing, sanitation, etc.
- Helping national and local governments to meet the challenges of scaling-up the rural housing programme for the poor without compromising on quality or the local context.
- Enable UNDP to develop and work closely with local producer groups, private sector and financial institutions to innovate and enhance access to composite building materials.
- Help concerned institutions to standardize local building materials.
- The housing program as currently implemented will hardly improve the living standards of the poor nor it will contribute to social justice.
- Before more funds are spent toward public housing, the government is well advised to reconsider its approach to the problem.
- In arriving at a new strategy for housing, planners must not lose sight of other, interrelated goals such as offering basic amenities, preventing diseases and assuring social integration.
- The approach must shift from the current focus on offering shelter to developing healthy and integrated communities. That might imply a departure from a caste-based approach to assistance based on income levels.

Some Important Aspects Needing Further Attention are

Social Integration

A great majority of the poor belong to lower castes at the present time and therefore would be eligible for assistance under this approach. Those belonging to higher castes should not be denied assistance if they deserve it for reasons of low income. Only then would it be possible to bring about social integration between different castes.

This will also permit upward mobility for lower caste families who are able to afford better and bigger homes. Mixed-income housing programs

have been successfully implemented in countries like the U.S. to bring about integration across race and class. India should not shy away to take lead in similar approaches to achieve social equality among all its citizens.

Develop New Housing Rather than Replacing Existing

Instead of replacing huts with cemented houses at the same location, a better strategy might be to develop new communities at another location close by, which would offer: -

- Considerable flexibility in properly laying out the entire housing complex.
- New developments to incorporate facilities for sharing water, sewage processing and bio-gas production, as well as fruit and vegetable gardens and small shops.
- Shared resources instead of wasting the resources due to individual provisions.
- Everyone would live in healthy conditions, and overall productivity will increase considerably.

Implementation Strategy

- Sharing of Cost of Unit

The cost of unit assistance to be shared between Central and State Governments in the ratio 60:40 in plain areas and 90:10 for North Eastern and hilly states. Funds be transferred electronically directly to the account of the beneficiary.

- Technical Support in House Building

- Locally appropriate house designs, incorporating features to address the natural calamities common to the region be made available to beneficiaries.
- The unit size be enhanced from the existing 20 sq.m to up to 25 sq.m including a dedicated area for hygienic cooking.
- Support be provided at district and block levels for technical facilitation and addressing quality issues in house construction.

- Use of Alternate Materials for Rural Housing

- Industrial Wastes
- Clay-fly ash bricks
- Mine tailing in developing bricks
- Pre-cast concrete solid/hollow blocks
- Sisal fibre reinforced – fly ash cement roofing sheet

- Development of Skilled Labour

To address the potential shortage of masons, training for masons be undertaken as an ongoing process.

- Availability of Building Materials

To meet the additional requirement of building materials, manufacture of bricks using cement stabilised earth or fly ash should be taken up under MGNREGA.

- Monitoring of Targets

A National Technical Support Agency be set up to provide technical support to the Centre and States to facilitate construction of the houses targeted and to ensure their quality.

EFFORTS OF THE GOVT. IN PROVIDING RURAL HOUSING

- Indira Awas Yojana

The Government of India has been taking all necessary steps to meet the shortage of rural housing for quite some time. Indira Awas Yojna Rural Housing initiatives in its true sense and vigour in India began with a sub-scheme of RLEGP in 1985-86. From April 1989, it became a sub-scheme of the Jawahar Rozgar Yojana (JRY). Since 1996, however, it was delinked from JRY and made an independent scheme.

- Pradhan Mantri Awas Yojana – Gramin

Under the Pradhan Mantri Awas Yojana – Gramin (PMAY-G, or Housing for All), the world's largest housing programming for the rural poor, India aims to build 30 million houses for the rural poor for 2022 – which means building five million houses every year in rural areas.

Financing Rural Housing

In addition to the government undertaken fully subsidized IAY, there are other national as well as regional financial institutions which provide loans in concessional rates. The institutions of finance associated with rural housing are: -

- Housing and Urban Development Corporation Ltd
- National Housing Bank

Research Agencies in Rural Housing

Development of low-cost but quality housing material, suitable housing designs etc. play an important role in ensuring housing security to millions of people. Some important institutions working in developing suitable building materials and designs are: -

- Central Building Research Institute, Roorkee
- National Institute of Rural Housing
- Advanced Materials and Processes Research Institute, Bhopal
- National Building Construction Corporation Ltd
- Building Materials and Technology Promotion Council

CONCLUSION

As per Census of India 2011 shortage of housing is about 52 million, which is alarming and needs immediate attention and action. There is a need of Rural Housing to create sustainable communities for economic growth of India.

The rural housing in India is often dominated by concerns of poverty alleviation and the effectiveness of the delivery systems. Rural Housing lags behind urban, both in terms of the current and future scenarios.

Poor people do not have the financial means to buy or construct houses with their savings. This should be supplemented by grants for buying lands and construction of shelter. Lack of Rural Housing Badly Effect the Health of Rural people.

People belonging to Scheduled Castes (SC) and Scheduled Tribes (ST) live in an area designated for them. Housing schemes should be integrated for all castes and loans and grants should be depending on financial status only.

Efforts of the Govt. in Providing Housing to People needs Review and Monitoring both at State and Central Govt. level with sourcing of adequate financing to achieve relief to rural homeless people.

AFFORDABLE HOUSING DELIVERY MODEL FOR URBAN POOR BY EXPLORING THE ALTERNATIVE SYSTEMS OF HOUSING IN URBAN INDIA

PREETHA R SAJIN*

Abstract

Habitation is one of the most important social needs in our lifetime. It has a direct and positive impact on health, status, attitudes, and values of the population concerned. Since the time of Independence, India had a strong vision towards housing. It has a long history of establishing policies, programmes, and institutions to cater to housing needs. Yet its provision for all seems to allude our society and the outcome so far in ameliorating the shortage has been marginal. We can put the blame on the phenomena called "Rapid Urbanisation".

In India, urbanization is mainly due to demographic explosion and poverty induced rural-urban migration. Sadly, the main reason for the rural to urban migration is not the pull of the urban area but the push from the rural area.

A run-up in housing prices due to the demand, speculation and exuberance often ruin economies, creates 'Housing Bubble" which later lead to housing crises and ruin many lives. Options for accommodation delivery are mostly based on the free market, whether they be in the private or the almost non-existent social and affordable sector. The prevailing procurement methods have clearly failed to meet such a basic need yet alternative options are limited and are not encouraged by government or private sector.

This paper, tries to critically analyse the real causes behind the poor supply/quality of housing especially for the urban poor and their affordability towards housing. And later, come up with proposal towards an affordable housing delivery model for them in an integrated and inclusive manner by exploring the alternative systems of housing in urban India. An interdisciplinary and multi-dimensional approach is discussed to derive a holistic solution towards housing for urban poor. The focus is essentially on housing as a system rather than a product.

INTRODUCTION

In major cities and around its peripheral areas of India, population growth has been very rapid and tremendous. This has led to an increased demand on housing, making it difficult and challenging to afford a decent house with proper infrastructure. Habitation is one of the most important social needs in our lifetime. As per Burns and Grebler (1977), housing condition have a direct and positive impact on health, status, attitudes, and values of the population concerned.

According to 2011 census, India had a population of 1,210.98 million, out of which, 377.10 million (31.16%) lived in urban areas. It is estimated that in the next 20 years more than 40-45% of population will be residing in the urban areas. In India urbanization, an index of transformation from traditional rural economy to modern industrial one, is mainly due to demographic explosion and poverty induced rural-urban migration. Sadly, the main reason for the rural to urban migration is not the pull of the urban area but the push from the rural area. Scholar Breese (1969) termed this phenomenon as pseudo urbanization. An assessment of this

*Associate Professor, Sushant School of Art and Architecture, Ansal, Gurgaon.

phenomena shows overall metropolitan stagnation-the core, suburbs and peripheries combined – in the concentration of people and job. The poverty led migration has induced a poor quality of urbanization. Indian cities are not equipped to cater to the negative impact of urbanization, which reflects on the housing sector too.

Currently, there exists a wide gap between the demand and supply of housing (both in terms of quantity and quality) in urban India.

The estimates proposed by the Technical Group constituted by the Ministry of Housing and Urban Poverty Alleviation (MHUPA), during the 11th Five Year Plan states that the total urban housing requirement (including the backlog) in the country by the end of 2012 will be approximately 26.53million dwelling units for 75.01million households. The group further estimated that the housing shortage for economically weaker section (EWS) is approximately 88% and for lower income group (LIG) it is around 11% and for middle and higher income group (MIG and HIG) it is 1%. Since the poor are not able to access or afford housing in the formal housing market, millions of poor households have turned to informal settlement where either vacant state owned or private land has been illegally occupied and used for housing requirement. The main source for affordable urban housing supply is through:

- Public housing at affordable rates by various public housing agencies
- Self-Built or self-financed housing, often illegal, by way of squatting on land not always belonging to the dwellers
- Private Enterprises with or without partnership with government agencies built affordable housing

INFORMAL SETTLEMENT

An 'informal settlement' as per UN Habitat Programme, is a residential area where a group of housing units have been constructed on land to which occupant have no legal claim or which they occupy illegally. These are the settlements where housing is not in compliance with the current planning and building regulation. There are various other terms for informal settlements, for example: unplanned settlements, squatter settlements, marginal settlement etc. Compared to other urban dwellers, people living in informal settlements suffer from more spatial, social, and economic exclusion from the benefits and opportunities of the boarder unban environment.

HOUSING SCENARIO IN INDIA

From the time of independence, India had a strong vision for housing. It has a long history of establishing policies, programmes, and institutions to cater to housing.

During the 1947-64 period, the policies were more towards forced eviction through Slum clearance and strict imposition of development control. The government role was more of a provider than a facilitator as they were providing housing for industrial workers and providing provision for subsidies.In 1964 a technical wing of Ministry of Urban Development with responsibility for preparing Master Plan for Delhi was formed. The focus was on intervention through land, material, construction, and finance.

During 70's to 80's, many new schemes were introduced like environmental improvement of slum scheme (1972), site and service scheme (1980). It was during this period when housing financing sectors like HUDCO, HDFC were created. In the year 1987, National Housing Board was set up and a comprehensive National Housing Policy was formulated in 1988.

Between 1990 and 2000, which is known as decade of liberalization, the realignment of power distribution between central, state, and local level of government took place. The management of urban services, protection of weaker section and various government schemes like Urban Poverty Alleviation, Slum Upgradation was transferred to Local Bodies. Integration of programmes was encouraged.The environmental improvement of urban slum was integrated with Urban Basic Service scheme. Many

new programmes were launched like: National Slum Development programme, Nehru Rozghar Yojana, Prime Minister's Integrated Urban Poverty Eradication Programme, Centrally sponsored VAMBAY (Valmika Ambedkar Awaz Yojana), Night Shelter scheme, 2 million housing scheme and JNNURUM (Jawaharlal Nehru National Urban Renewal Mission). Urban Land Ceiling Regulation act was repealed during this period. Liberalization of Housing Finance happened in early 2000's.

Between 2000 to 2010, the economy moved into the globalization and privatization period which is largely privately led, service sector oriented and city driven. Policies and programmes were on infrastructure development. Cities were back in focus through program such as reform-led infrastructure investment programmes for cities- The Jawahar Lal Nehru National Urban Renewal Mission (JNNURM), Housing Program like Rajiv Awas Yojana (RAY) in 2011.The main objective of RAY was to bring the existing slums into the formal system but it didn't get much response from ULB.

In year 2015, our government has taken yet another significant step towards housing by launching Pradhan Mantri Awas Yojna: "Housing for all by 2022". This mission was started with the ambition to fulfil it within 7 years. The salient features of this mission are:

- Subsidy for beneficiary led individual house construction,
- Promotion of affordable housing for weaker section through credit linked subsidy,
- Affordable housing in partnership with Public and Private sectors and
- Rehabilitation of slum dwellers.

But so far, the implementation strategy is weak. Till now under this new scheme, the total completed dwelling units are 2883 and 72,000 dwelling units are in the construction stage. The target is to build around 2 crore houses by 2022 for urban poor

In other words approximately 30lakh dwelling units in a year. But at this rate we won't be able to build more than 5,00,000 DUs. The main factors responsible for the poor implementation so far by this programme too could be considered as same as the previous programmes. Government not being able to clearly define what an affordable housing unit is. There is no clarity on how many houses are built and where, as the government is not able to do a strict monitoring of the housing output. There is also a supply constraint in the form of availability of land, financial aids and other factors caused by regulatory requirements.Delay from states in submitting proposal to Ministry under the mission is also a major reason for the poor implementation.

AFFORDABLE HOUSING

Affordable housing is the housing provision which addresses the housing needs of people especially the economically weaker section (EWS), lower income group (LIG) and to an extent the middle-income group (MIG). Affordability holds different meaning for different categories of demographics. There are several socio-economic variables governing the city or location which influence the housing affordability. But the disposable income of the people remains the primary factor in determining the affordability.This disposal income is almost inconsequential amongst the EWS and LIG category. Middle-income groups also do not have sufficient funds to buy a decent-sized property of their preference, which is closer to the employment hubs or convenience available within the city-limit.

Affordable housing becomes a key issue especially in developing nations where a majority of the population is not able to buy houses at the market price. As a result, it becomes the increased responsibility of the government to cater to the rising demand for affordable housing.

As per Pradhan Mantri Awas Yojana, Housing for All (Urban) scheme guidelines of 2016, the Housing and Urban Poverty Alleviation Ministry made an upward revision on the criteria that define EWS and LIG. EWS households are defined as households having an annual income up to Rs.

3,00,000 (Rupees Three Lakhs). LIG households are defined as households having an annual income between Rs.3,00,001 (Rupees Three Lakhs One) up to Rs.6,00,000 (Rupees Six Lakhs). States/UTs shall have the flexibility to redefine the annual income criteria as per local conditions in consultation with the Centre.

As per the Union budget of 2017, for affordable housing purpose, instead of the built-up area of 30 and 60 sqm, the carpet area of 30 and 60 sqm will be counted. The 30 sqm limit will apply only in case of municipal limits of 4 metropolitan cities while for the rest of the country including the peripheral areas of metros, limit of 60 sqm will apply.

The Task Force on 'Affordable Housing for All' defined affordable housing in terms of a) multiples of household income; b) size of the tenement and c) percentage of household income in case of rented accommodation. This expenditure approach to housing affordability considers whether households can afford a house based on their income levels which is measured through rental affordability and purchase affordability ability. This approach assumes that housing and basic non-housing goods are merit goods, having a socially desirable minimum (Hancock, 1993). Stone (1993) define affordability as the ability of households to pay the costs of housing without imposing constraints on living costs. Freeman, Chaplin, and Whitehead (1997) uses a relative measure of housing expenditure and household income, and provides a theoretical basis for relative or absolute measures of affordability based on the ratio approach of housing expenditure to household income. But affordability can't be based on just this one approach.

Some researchers (Gan & Hill, 2009) have calculated the repayment affordability measure which acknowledges that while housing may be affordable at the time of purchase, the repayments towards housing may become unaffordable subsequently due to market and interest rate risk. Housing affordability can also be based on location affordability which considers the transportation costs of housing choice. Affordable livability refers to affordable structures which should be supported by availability of hard infrastructure (physical infrastructure) such as water, electricity, communication, and transportation, as well as social infrastructure such as schools, hospitals, police station, governance mechanisms, and so on. Community characteristics as well as amenities combine to provide affordable liveability.

These definitions highlight the relevance of affordability for urban poor, who in the absence of affordability towards formal housing resort to slums and informal settlements.

WAY FORWARD: CHALLENGES AND POTENTIAL

Developing an Affordable Housing delivery model especially for Urban Poor on a large scale is the biggest challenge in urban India today.

By looking at the trend so far, if immediate positive initiative is not taken then the current programme for housing, the Pradhan Mantri Awas Yojna: "Housing for all by 2022", too would end up with the same fate as the previous programmes and policies since independence, which were all well intended in terms of their objectives, they could not deliver due to lack of financial resources, superficial scarcity in land, higher land prices due to expensive land procurement process for housing.

It was also observed through the 2011 census, that in Urban India 11.09 million housing units are vacant and 0.73 million are occupied but locked. If we check the Delhi housing scenario, it has 4.5 million houses with a shortfall of 18.6 million units and out of 4.5 million houses, 11% are vacant. This means that if the incentive programmes for the affordable housing is not designed and implemented well, it may incite misuse of the subsidies available for affordable housing for speculation and defeat the purpose of meeting the housing need of all poor. Therefore, it becomes relevant that we not only think in the lines of ownership subsidy for housing but also low-income rentals for housing.

Generally, the policies are made without collecting the real information about slums,

specifically their scale, location, extent, boundaries, population, buildings, and enterprises, the geographical and spatial dynamics are not taken into considerations.

Exploring the physical characteristics of slum along with socio-economic characteristic is equally important. Remote sensing is a tool that can play a key role in analysing 'space-time' dynamics such as monitoring densification and expansion processes. It also allows linking the urban morphology with socio economic parameters. It is important to combine such spatial information with community driven mapping to understand local needs.

Housing affordability which so far was based on household income and their expenditure should also take into consideration other parameters like repayment ability, location affordability, affordable liveability etc.

CONCLUSION

It is important we address affordable housing in a holistic manner through a multi-dimensional and interdisciplinary approach.

We must move from the generic definition of affordability towards a clearer and relevant definition of affordability which is based on the location, income, household size, living condition based on social and physical infrastructure etc.

We must clearly identify and chart out the critical issues on both demand side and supply side of housing and come up with a model for housing which is contemporary and consider sustainable design, inclusive design, and community participation as the core principle of planning and designing.

Since affordable housing calls for collaborative, multi-branched and determined effort from all stakeholders a detailed exploration on the role of stakeholders: public, private, people towards housing is necessary. Till now, public private partnership has been widely adopted to provide various infrastructure and services. Now we need to go beyond that where we can put people as a major stakeholder which bring the public engagement clearly visible. The decision-making power should deviate from policy makers to the citizens through proactive engagements.Therefore, formulating a model based on the 4-P[5] (Public, Private and People Partnership) will help in evolving an effective Affordable Housing Delivery Model for Urban Poor in India.

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AFFORDABLE HOUSING FOR ALL -TECHNIQUES AND TECHNOLOGIES

K.T. Gurumukhi* and Vijay Saluja**

Abstract

Over the years, there has been concentration of urban population of about 70 % in class I cities (468) with more concentration in metropolitan cities (53) as per 2011 census. This has led to the collapse of urban services besides deteriorating the quality of social fabric in all Metro Cities. By the year 2020, it is expected that India will have about 1350 million people and 60/65 metro cities. By the year 2030/40, estimated 1500/1600 million people absorbing nearly half of the urban population in million plus cities. At the global level, nearly 17 % population of the world will be living in India by 2050. This paper looks into managing urban growth that has become one of the most important challenges of the 21st Century, particularly in respect of affordable housing.

Housing is one of the basic requirements of any individual human being next to food and clothing. In today's context when India is heading towards excellent economic growth and entering into an era of overall development to become an economic power, it is more than essential that we create an enabling environment for affordable housing for all. The current agenda of the Government has been moving ahead through various programmes in order to fulfil this in the right earnest particularly to provide affordable housing for all by the year 2022.

INTRODUCTION

Affordable housing is housing appropriate for the needs in a range of very low to moderate income household and priced so that, the household is able to meet other basic needs such as food, clothing, transport, health care, education etc. As a thumb rule, housing is usually considered affordable if it's cost is less than 30 percent of the gross household income. The Affordable housing refers to housing units that are affordable by a section of society whose income is below the median household income as rated by nation, state, local body and recognized by Housing Authority.Affordable housing is a term used to describe dwelling unit of which the total housing unit cost is deemed "Affordable" to a group of people within a specified income range particularly the lowest income category. All over the world due to rising cost of land and housing number of homeless has been increasing steeply particularly in cities. They are forced to live in the open, filthy slums, under bridges, pavements etc. (Fig. 1 & 2) According to estimates made by Technical Group, constituted by the then Ministry of Housing and Urban Poverty Alleviation, Government of India for assessment of the urban housing shortage at the start of the 11th Five Year Plan (2007-2011), the total housing shortage in the country was 24.71 million dwelling units. As on 2012, only 24% of this demand had been addressed. The 12th Five Year plan (2012 – 17) states the estimated housing requirement till 2017 to be 18.78 million dwelling units. The need to meet this huge demand over a short span of time is a real challenge for the Government, the state agencies and the local bodies.

** Consultant & Former Chief Planner, TCPO., New Delhi, ** Former Chief Engineer, NDMC*

Fig. 1: Homeless forced to live in Slums or some kind of Shelter

CURRENT STATE OF HOUSING IN INDIA AND HOUSING FOR ALL BY 2022

- Housing shortage of about sixty million dwelling units including rural housing.
- Average growth of 5 to 6 per cent in real estate sector investments between FY 2008 and FY 2014.
- Both central and state governments are spending about USD 5 to 6 billion annually, about three per cent of current investments in real estate sector or one per cent of its annual expenditure.
- By 2022, India need to develop about 110 million housing units and beyond 2022 additional housing for 450 to 500 million people by 2050.
- Investments of more than USD 2 trillion or about USD 250 to 260 billion annual investment until 2022 to meet fiscal requirements and future plans for the next 30 years.
- Investments will need to grow at 12 to 13 per cent (unadjusted for inflation) till 2022.
- 70 per cent of the housing needs till 2022 will have to be concentrated in nine /ten major states.
- Urban housing is to account for about 75 to 80 per cent of the total investments with focus on affordability which is 70 per cent of total urban housing requirement mainly the low income group.
- About 200 to 250 thousand hectares of land is required to fulfil urban housing need by 2022 and further land needed for future urbanization to accommodate projected population.

Fig.2 : Slum Development near Work Centres

Key Considerations for Central Government to Provide an Enabling Framework for New Affordable Housing Development

- Absence of an effective policy framework for Economically Weaker Section (EWS) and Lower Income Group (LIG) housing and the reach of micro-finance measures.
- Long gestation period of five to six years of housing projects, accentuated approvals to be obtained from multiple authorities in two to three year time period.
- Inadequate long-term funding across the project life cycle necessitating multiple rounds of funding for the same project increasing cost of capital and time. Further, funding is not available for acquiring land from banking sources.
- Rationalization of multiple fees and taxes across project stages which inflate construction cost by 30 to 35 per cent.
- Reassessment of development norms such as low FAR/FSI, density norms, parking norms, and ground coverage, especially from the EWS and LIG housing development perspective.
- High urbanisation rate, coupled with high rate of migration from rural areas is stressing limited urban infrastructure, sub-optimal usage of

urban land (low FAR/FSI) which has resulted in raising the cost per unit of built-up area.

- Innovative approach to new housing construction techniques and technology including the use of cheaper building materials locally available, adoption of green development technology considering climate change.

There is a pressing need of integrated city planning on two fronts: firstly, an extensive; problematic term spatial planning accounting for housing shortage and associated urban infrastructure like roads, highways, energy, sewerage, water, waste management and multimodal transport system, secondly, focus on development of new satellite towns to meet the rising urban and rural housing needs and developing smart cities. Lack of coordination between central and state departments can be countered by introducing regulatory reforms, space standards with a view to substantial increased housing, construction capability, labour force availability, construction materials for housing affordability.It is an attractive sector driven by a strong fundamental housing demand – large low income population, population growth, urbanization and increasing trend towards nuclear families. Several supply and demand side challenges were responsible for the underdevelopment of affordable housing sector in the past.Affordable Housing demand range between (unit cost between Rs. 3-10 Lakhs), Mid Income housing demand (unit cost between Rs. 10-25 Lakhs) Affluent Housing demand (unit cost between Rs.30-50 Lakhs). Rapid urbanization leading to huge demand - supply gap, increased access to Low Income HousingFinance and favourable regulations/ technological advancement have mitigated these challenges and created opportunities for super-normal returns.

Problems Faced

There is an increase in the cost of construction materials and labourers due to many reasons, increase of energy cost, political influence etc. The awareness of new techniques and technology invariablyis not reaching to the public. The cost of construction has increased by 50% over nominal inflation due to hike in the cost of basic building materials and labour in a span of last 20 years. Nowadays many cost control techniques are being introduced in project works to optimize the cost. With the advancement of technologies, it becomes necessary to have a critical examination of various techniques and construction materials at periodical intervals so as to discard ineffective construction practices and materials, adopt newer effective techniques and materials.

There is a huge misconception that low cost housing is suitable for only substandard works and they are constructed by using cheaper building materials of low quality. But the fact is that cost effective housing is done by proper management of available resources. Economy is also achieved by postponing finishing works or implementing them in phases. Every Builder, Engineer or architect understand the importance of reducing construction cost. In very recent years the cost of construction has increased much faster. The rising cost of shelter is the present scenario in housing, which affects all of us. Cost of project depends on various major and minor heads of expenditure. These can be classified into two parts: A) Direct cost B) Indirect cost.

Direct cost: It is defined as the actual expenses incurred on construction project. It includes land, material and labour expenses

Indirect Cost: It is defined as the correlated expenses incurred for the construction of building other than materials, labour and land cost. It includes:

- Sanction and consultancy expenses.
- Site development and site running expenses.
- Administrative expenses.

Implementing Cost Effective Construction

Cost effective construction is a new concept which deals with effective budgeting and following techniques which help in reducing cost of construction through use of locally available materials along with improved skills and technology without sacrificing the strength, performance and life of the structure. Cost effective technology allows reduction of costs and preserve scarce resources. Cost Effective construction is achieved through four ways :

- By replacing conventional materials with alternative materials.

- By good construction skills which also heads to cost saving.
- By proper building design which in turn leads to reduction in cost.
- By proper planning and management of construction.

Technologies

- Various Cost effective technologies must be employed in mass housing schemes.
- Techniques must ensure beneficiary participation on self-help basis for construction, Maintenance.
- The beneficiaries must consult and seek help from NGO"s for construction of houses by using cost effective techniques and appropriate usage of alternative materials.

Design

- Reduce plinth area by using thinner walls.
- Building should be in regular shapes such as square, rectangle.
- Basement area should be avoided and floor height is kept the minimum as per regulations.
- Using of precast component wherever possible.
- Design of houses must ensure light and ventilation.
- The units must haveat least one habitable room.
- Wherever possible the house must be designed minimising costly conventional materials.
- Maximize use of locally available building materials to complete construction of houses within limited resources.
- Use energy efficient materials in place of burnt bricks.
- Use environmentally friendly materials as substitute to conventional building components.
- Planning each and every component of house to avoidwastage of materials.

Development Criteria

- The location of housing and the transportation options affect affordability.
- Dispersed housing cannot support public transit, pedestrian options which can make automobile ownership a necessity. The cost of housing hence, is combined cost of housing and transportation.
- Housing construction approaches also determine home's affordability.
- Smart growth approaches support construction of houses using green building techniques and materials in locations within a range of transportation choices.
- Smart growth strategies are critical part of response to climate change.
- Houses using energy and water efficiently can help low-income households to cope with economic impacts related to climate change which could include volatile energy, water prices and supplies.
- Houses that maintain habitable conditions in extreme heat, power outages and storms are crucial in protecting the inhabitants.

Aspects of Cost Reduction

- Optimization of land use.
- Functional design of buildings.
- Optimum use of building materials.
- Rationalization of specifications.
- New construction materials and techniques
- Improved skills and technology, without sacrificing strength, performance and life of the structure.
- Using recycled materials and energy efficient materials.
- Extensive planning, modular construction.

Low Cost Building Component

- Precast solid fly ash cement concrete as well as hollow concrete blocks.
- Precast reinforced concrete door and window frames.
- Ferrocement door shutters and ferrocement roofing channels.
- Precast ferrocement water tanks.
- Precast concrete/PVC manhole covers and frames.
- Bamboo mat corrugated roofing sheets.
- Precast reinforced concrete joist and plank system for flooring/roofing.
- Thin R.C.C. ribbed slab for floors and roofs.
- Precast doubly curved shell units for floors and roofs.
- Prefabricated brick panel for floors/roofs.

Building Construction Research and Making Technology Green

- Optimization of design to achieve energy efficiency.
- Develop building materials, equipment and techniques in construction that can sustain life without polluting environment.
- Disseminate results of research and development activities through demonstration projects, educational programs, trainings and publications.
- Minimizing use of water at site and usage of recycled aggregates in concrete.

MASS HOUSING

Precast Construction Panels for walls including partition walls, roof, sunshades,staircase etc., use of hallow concrete blocks, pre-engineered formwork system, precast concrete frames for doors and windows, other homogenous concrete material components.Green building materials are composed of renewable, rather than non-renewable resourcesand achieve efficiency in indoor air quality, energy efficiency and water conservation; water efficiency through rain water harvesting and recycling and reuse of waste water.

The layout for inclusive housing inKitui Planning Area, County Government of Kenya demonstrated affordable housing project where cross subsidy has beenextended to low income group by marginally raising cost of dwelling unit of middle / upper income groups, partially bearing the cost of dwelling unitsto make housing affordable by the poor besides adopting innovative building techniques / technologies as suggested. 66 % of total proposed 2400 DUs comprise low income DUs.

SIMPLIFIED BUILDING CODES, REGULATIONS, STANDARDS AND SPECIFICATIONS

- Reforming building regulations, development control rules.
- Promoting new technologies and extending incentives, concessions towards adaptation of cost effective construction methods.
- Declaration of tax holidays to encourage adding up more housing stock by private sector.
- Building basic core infrastructure such as main water supply and sewerage lines, transportation network, laying electric and communication lines, gas supply pipe lines etc. by Govt. Agencies.
- Framing rules for cross subsidy and cost of dwelling unit to make it affordable.

Logical Approach for Optimizing Housing Solutions

- There should be optimal space in design considering efficiency of space, minimum circulation area.
- Economy should be considered in design of individual buildings, layouts, clusters etc.
- While preparing specifications it should be cost effective construction systems.
- Energy efficiency is important due to energy crisis especially in developing countries.

Orientation, built–form, openings and materials play a vital role besides landscaping / outdoor environment.

- Develop an effective mechanism for providing appropriate technology based shelter particularly to the vulnerable group and economically weaker section.

Pre-Fabricated Construction Techniques

- In prefabricated construction, as the components are readymade, self-supporting, shuttering and scaffolding is eliminated with a saving in shuttering cost.
- In conventional methods, the shuttering gets damaged due to its repetitive use because of frequent cutting, nailing etc. On the other hand, the mould for the precast components can be used for large number of repetitions thereby reducing the cost of the mould per unit.
- In prefabricated housing system, time is saved by the use of precast elements which are casted off-site during the course of foundations being laid. The finishes and services can be done below the slab immediately. While in the conventional in-situ RCC slabs, due to props and shuttering the work cannot be done till they are removed thus, saving time and money.
- In precast construction, similar types of components are produced repetitively resulting in increased productivity and economy in cost too.
- In prefabricated construction, the work at site is reduced to minimum, thereby, enhancing the quality of work, reliability and cleanliness.
- The execution is much faster than the conventional methods, thereby, reducing the time period of construction which can be beneficial in early returns of the investment
- The concept of prefabrication /partial prefabrication has been adopted for speedier construction, better quality components and saving in material quantities and costs.

Floor and Roof

Structural floors/roofs account for substantial cost of a building in normal situation. Therefore, any savings achieved in floor/roof considerably reduce the cost of building. Traditional Cast-in-situ concrete roof involve the use of temporary shuttering which adds to the cost of construction and time. Use of standardized and optimized roofing components where shuttering is avoided prove economical, fast and better in quality. Some of the prefabricated roofing/flooring components found suitable in many lowcost housing projects are:

- Precast RCC planks, concrete and curved panels.
- Prefabricated brick panels.
- Precast RCC channel roofing.
- Precast hollow slabs.

CONCLUSION

Realizing the challenges, Government of India has undertaken several initiatives to boost the affordable housing. The Ministry of Housing and Urban Affairs has drafted the proposals that allows households where annual income is less than 2 lakh who can apply for subsidized housing. In the past, development of affordable housing has mainly been the Government's responsibility. However, in the past few years, the housing sector has seen increased participation of private players. Private public participation will play a big role in boosting affordable housing in India. Fast tracking of clearances is essential to make affordable housing attractive among the buyers and help people come out of cramped and poorly constructed homes with new housing techniques and technological approaches. All the State Authorities should set up Real Estate Regulatory Authority (RERA) under the Chairmanship of a Secretary level Officer, a town planner, civil engineer, architect as it's members to enforce the Act and monitor the implementation of the projects. As a policy a serious thought should be given by the Government on population control policy linked with incentives and disincentives along with the growth to overcome the challenges and to achieve the vision set for affordable housing for all.

TECHNICAL SESSION III : SUSTAINABLE MATERIALS & DEVELOPMENT

HOUSING FOR ALL IN URBAN AND RURAL AREAS

Lt. Col. Arunsekhar*

Abstract

Innovative construction material and methods are the key to achieving the objectives laid down for mass housing programmes. It is an accepted fact that Govt has to be a facilitator in housing sector and public private partnership is the mantra to tackle the challenges in making available the best technology, manpower and resources. Building professionals have a larger role to play in bridging the gap of traditional methods and new technologies.

Glass Fiber Reinforced Gypsum panels can be effectively used for mass housing both for urban and rural areas. IIT Madras has carried out extensive research on the material and residential complexes up to eight storeys can be constructed using these panels by design methodologies developed by the researchers. Qualified technicians are required to construct the GFRG system as these thin panels have to act as load bearing walls and floors.

INTRODUCTION

Housing policies of Govt. of India have come a long way since 1947. Over these decades, the role of Govt. has also changed gradually from being a provider of housing to merely a facilitator of housing activity. A historic overview of the various five year plans might throw some light into the road we have already travelled and pave the way for goals to be achieved in the next two decades.

Immediately after Independence our country faced huge challenges in providing housing due to large scale migration. In the early years (1950-69) Govt. declared that it will take up the challenge of providing housing for all. This resulted in the central government bringing out various schemes for different sections of society. While constitutionally it was not clear whether Central government or States should take this responsibility. Central government took initiative in Urban sector housing, and brought out schemes like Subsidized Housing Scheme for Industrial Workers (1952), Low Income Group Housing Scheme (1954), Middle Income Group Housing Scheme (1959) and Slum Clearance and Improvement Scheme (1956) etc. State Governments were asked to take up the responsibility of housing in rural areas. National Building Organization was created in 1954 to facilitate research in building construction activity, Town and Country Planning Organization came into existence in 1962 to facilitate spatial planning activities across the country. At the state level, various Housing Boards were created during the same period. The main objective of these housing boards was to take up housing activities for all the sections of society with a special focus on Lower Income Groups (LIG). Central Govt asked state governments to create special agencies to take up construction activities, which would also be involved in controlling and developing the land in its boundaries. For this purpose, Delhi Development Authority (DDA) was created in national capital in 1957, which later on became a model for creation of other development authorities across many cities.

After various experiments in the first phase, the government finally realized in the second phase (1970-89) that it cannot provide housing to all, as it envisaged earlier. This realization was quite visible in the drop of number of housing related schemes floated by the government for the sections other than poor or socially backward. During this period, government housing schemes were especially focused on lower sections of the society. Other sections were encouraged to take up housing activities as self-provisioning activity with limited

**Staff Officer, HQ Chief Engineer Leh Zone*

support from the government. In the second phase government started focusing on low cost schemes like Environmental Improvement Scheme of Urban Slums (1972) and Sites and Services Scheme (1980) to tackle the problem of slum proliferation. Hence, with a vision of "controlled and well-directed growth" of the housing sector, the government created a national level Housing and Urban Development Corporation (HUDCO) in 1970. At its inception, HUDCO was envisaged as an institution which will work as the government's nodal agency in promoting "sustainable habitat development to enhance the quality of life".

During 1980s to 2000 the government was in the process of liberalizing the economy, which was also visible in its housing policies. Its housing policies had started talking about restricting government's role as a provider of housing in the country and pushed it to take up the role of a facilitator in this sector. The Seventh Plan advised the government that "Government's role in the field of urban housing has per force to be promotional. The major effort will have to come from the private sector, Government's role will have to be restricted to the improvement of slums, direct provision of housing to the weaker sections of the society and encouragement and support of housing finance institutions" Even the responsibilities of slum improvement and weaker section housing were being tried to be pushed towards lower tiers of governments.

The central government's schemes after 2000 were focused only on weaker sections of society (Valmiki Ambedkar Awas Yojna in 2001, which was later merged with BSUP under JnNURM in 2005 and then in Rajiv Awas Yojna in 2013) are advocated to be implemented on Public Private Partnership (PPP) basis. With a focus on facilitating private investment in this sector, Government has allowed 100% FDI in housing sector and the latest budget (2014-15) has gone one step further in this direction by listing slum redevelopment as a CSR (Corporate Social Responsibility) activity to attract more private funds.

PRADHAN MANTRI AWAS YOJANA (URBAN)

The Mission will be implemented during 2015-2022 by Ministry of Housing & Urban Poverty Alleviation and will provide central assistance to Urban Local Bodies (ULBs) and other implementing agencies through States/UTs for:

- In-situ rehabilitation of existing slum dwellers using land as a resource through private participation.
- Credit linked subsidy.
- Affordable housing in partnership with private and public sector.
- Subsidy for beneficiary led individual house construction/enhancement.

PRADHAN MANTRI AWAS YOJANA (GRAMIN)

This scheme is being implemented by the Ministry of Rural Development which intends to provide hundred Lakhs houses by 2019 in its first phase and cover all rural household by 2022. Since the rural housing scheme is spread over vast geographical regions, locally available materials will govern the design of the houses considering varied climatic conditions. To address the challenge of large scale construction of quality houses on sustainable basis, ministry of rural development initiated a study of housing typologies for each state. Housing prototypes have been developed for each housing zone with in a state based on the climatic conditions, disaster risk factors, local materials and traditional skills.

ROLE OF BUILDING PROFESSIONALS

For the success of any massive scheme like PMAY, right kind of technology has to be adopted where time lines can be met with speedy construction. Modern and innovative methods have to be adopted to deliver high quality construction which ensures durability and lesser maintenance. The role of engineers in providing affordable housing is huge as they have to make it economically

viable, energy efficient, aesthetically pleasing and environmentally responsible. This is only possible when engineers deliberate on issues on design, planning, Slum development, affordable housing technology, development of Land and thoroughly evaluate the existing case studies.

CONCEPT, DESIGN AND PLANNING FOR MASS HOUSING IN URBAN AREA

Any mass housing technology in urban area has to be based on minimum labour, minimum time and maximum utilization of available land. Pre fabricated /pre- engineered material is the key to reducing labour and time. Conventional framed structure may not be most economical when it comes to going vertical to take advantage of the revised FAR (Floor Area Ratio) of NBC. Since land is at premium in urban area, we have to accommodate more dwelling units in lesser area.

GLASS FIBRE REINFORCED GYPSUM (GFRG) PANEL AS THE BASIC BUILDING MATERIAL

GFRG is the name of a new building material made essentially of Gypsum Plaster, reinforced with glass fibre. It is known in the industry as Rapidwall. This product is suitable for mass scale building construction, especially in India where gypsum is abundantly available as an industrial by-product waste. The product is not only eco-friendly, it is resistant to water and fire. GFRG panels are manufactured to a thickness of 124mm, a length of 12m and a height of 3m under carefully controlled conditions. The panel can be cut to required size. Although its main application is in construction of walls, it can also be used in floor and roof slabs in combination with reinforced concrete.

The panel contains cavities that may be filled with concrete and reinforced with steel bars to impart additional strength and provide ductility. The panels may be unfilled, partially filled or fully filled with reinforced concrete as per structural requirement. Experimental studies and research (IIT Madras) have shown that GFRG panels suitably filled with reinforced concrete possesses substantial strength to act both as load bearing and shear walls capable of resisting lateral loads due to earth quake and wind. It is possible to design such buildings up to ten storeys in low seismic zones and to lesser heights in high seismic zones.

ADVANTAGES OF GFRG PANELS

The advantages of GFRG panel construction are as follows:-

- Substantial reduction in structural weight of the building.
- No plastering required for walls and ceiling.
- Increased speed of construction with less manpower.
- Saving of cement, steel, river sand, burnt clay bricks/concrete blocks and hence saving of energy and reduced CO2 emission, contributing to environmental protection.
- Use of industrial byproduct ie waste gypsum is used to manufacture GFRG panels there by helping to reduce pollution and protect environment.

GFRG building systems can be constructed only with technical support by qualified engineers and constructors, based on structural design carried out in detail complying with prevailing standards. GFRG panels can be unfilled when used as partition walls, but when used as external walls, need to be suitably designed to resist the wind pressure. For single storey construction unfilled GFRG panels can be used for walls as well as roof (pitched roof) with reinforced concrete filling at the joints between walls and between the roof and the wall. It is mandatory to provide embedded RC horizontal tie beams over all the walls below the floor slab/roof slab.

Based on the tests and independent evaluation by IIT Madras and SERC Chennai, BMTPC (Building Material and Technology Promotion Council) has accorded approval of GFRG panels for construction in India. IIT Madras has prepared a detailed design manual for GFRG panels. Fig 1 gives the dimension and cross section of a GFRG panel and fig 2 gives

the detail of a cell.

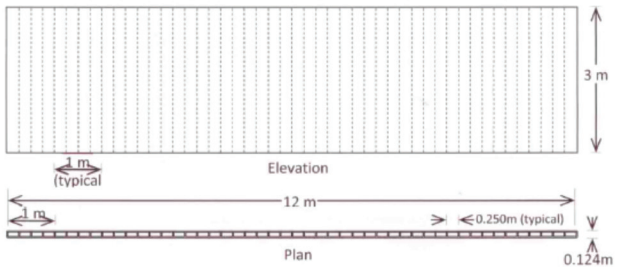


Fig. 1: Typical Cross Section of GFRG Panel

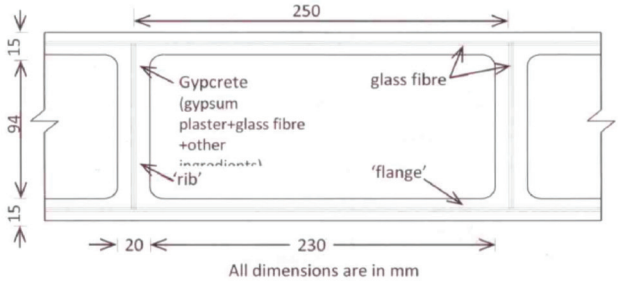


Fig. 2: Enlarged View of a Typical Cell

APPLICATIONS

GFRG building panels are generally used structurally in the following four ways.

- Load Bearing
- Partition
- Compound Walls
- Floor Slabs/ Roof Slabs

In typical multi-storeyed construction where GFRG is used as load bearing walls, connection between cross walls and foundation is achieved through RCC filling. All GFRG wall panels are to be erected over network of RC plinth beams supported on suitable foundation (strip masonry footings). Starter bars shall be embedded in RC plinth beams at the precise locations where cavities are to be filled with RCC. Fig 3 shows the arrangement of connection between wall and plinth beam. Fig 4 shows a photograph from actual site. For constructing an additional GFRG floor above an existing RC building, connectivity between GFRG wall and existing floor can be achieved by proper detailing (Insertion of starter bar with proper anchorage) as shown in fig 5. If existing floor slab does not have sufficient depth for anchorage, an additional RC beam may be constructed above the roof before erecting GFRG walls. When GFRG is used for structural walling, an embedded horizontal RC tie beam has to be provided on top of all walls. Tie beam size of 200mm depth and 94 mm width is suggested by cutting and removing the top portion of the web of panels as shown in Fig 6.

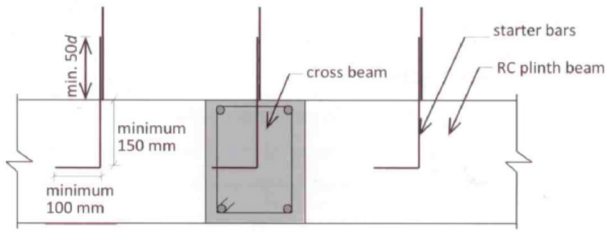


Fig. 3: Provision of Starter Bars in RC Plinth Beam for Erection of GFRG Panels

Fig. 4 : Erection of GFRG Panels on Plinth Beams at Site

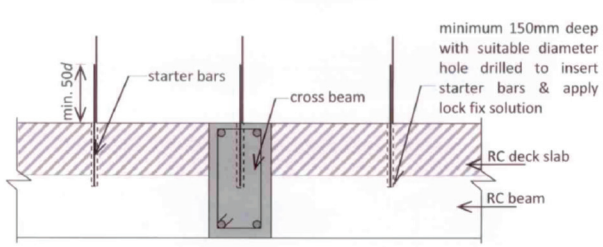


Fig. 5 : Starter Bar on Existing RC Floor / Roof Slab

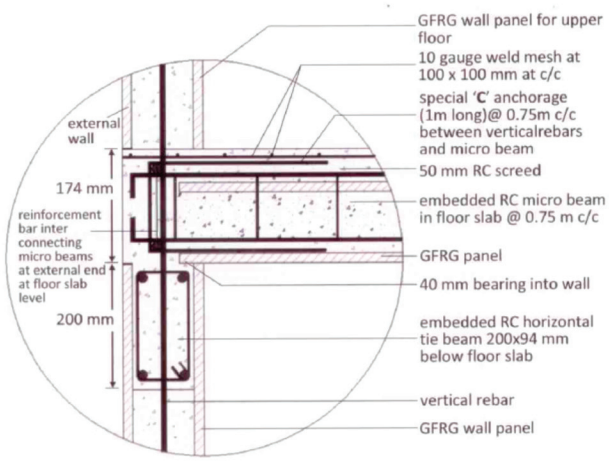
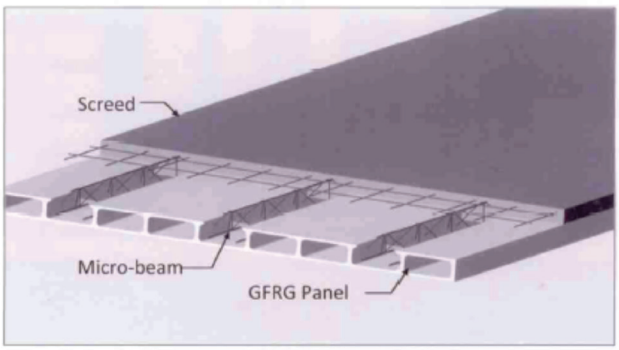
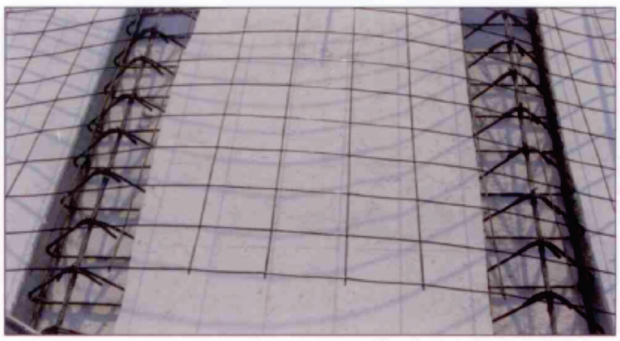


Fig. 6 : Connectivity between Floor Slab and Wall

GFRG panels can also be used for intermediate floor slab/roof slab in combination with RC (Ref Fig 7). The strength of GFRG slabs can be significantly enhanced by embedding reinforced concrete micro beams. For providing embedded micro beams, top flange of the respective cavity is cut and removed in such a way that minimum 25mm flange on both end is protruded as shown in Fig 7. RC concrete screed of minimum 50 mm thickness is provided above the GFRG floor panel which is reinforced with weld mesh of minimum size of 10 gauge 100mmx100mm. This RC screed and micro beam of act together as series of embedded T-beams. The thickness of RC screed, reinforcement and interval of embedded RC micro beams depends on the span and intensity of imposed load.



(a)



(b)

Fig. 7: GFRG Floor Slab with Micro Beam and Screed

DESIGN PHILOSOPHY

The design should be such that the structure should withstand safely all loads (as per relevant Indian Standards) likely to act on the structure during its life time. It shall also satisfy serviceability requirements, such as deflection and cracking. For ensuring design objectives, the design should be based on the characteristic values of material strength and applied loads which take into account the probability of variations in material strength and load. The design values are derived from the characteristic values through the use of partial safety factors. The various load combinations and the corresponding partial safety factor for loads as given in IS 456:2000 is given in table 1.

Table 1 : Values of Partial Safety Factor for Loads

Load Combination	Limit State of Collapse			Limit State of Serviceability		
	DL	LL	WL/ EL	DL	LL	WL/ EL
DL+LL	1.5	1.5	-	1.0	1.0	-
DL+WL/EL	1.5/ .9	-	1.5	1.0	-	1.0
DL+LL+ WL/EL	1.2	1.2	1.2	1.0	0.8	0.8

The magnitude of partial safety factor for the material must consider the uncertainty related to the material strength. Although GFRG panels are

manufactured under carefully controlled conditions, it is considered prudent to treat the material like concrete for which the partial safety factor specified is in IS 456:2000 is 1.50. In the case of reinforcing steel the partial safety factor shall be taken as 1.15.

RESPONSE REDUCTION FACTOR FOR EQ RESISTANT DESIGN

Earthquake resistant design shall be carried out in compliance with the requirements of IS 1893 (Part I). In such design an important and difficult task is the determination of the Response Reduction Factor (R). This is traditionally arrived at, based on the general observed performance of similar buildings during past earth quakes, estimates of general system toughness and the amount of damping present during inelastic response. As GFRG building constitute a new type of structure, a reasonable choice of 'R' factor can only be made by comparing the GFRG building system with traditional structures. GFRG walls are composite members with partial interaction, and the ductility of a partially interactive member is generally greater than that of a fully interactive RCC member. It is quite reasonable to treat buildings constructed with GFRG panels as reinforced concrete shear walls and to adopt the R value as 3 from IS 1893:2002.

GFRG WALL PANEL RESISTANCE AGAINST WIND LOADING

The external walls of the building are subjected to wind pressure. It is necessary to check the flexural resistance of the GFRG panel against such loading. One way bending action of the panel (Full height of 3m) can be assumed conservatively, with simply supported end conditions and a pressure coefficient of unity.

(a) Unfilled GFRG Panels:-

Considering the design moment capacity as 1.4 kN/m (From experimental verification)

Design bending moment in the panel due to wind = 0.6 (VZ)2 x 32 x(1/8) x 1.5

Equating this moment to the design moment capacity of the panel,

0.6 (VZ)2 x 32 x(1/8) x 1.5 = 1.4x 1000 Nm/m

VZ = 37.2 m/s (Max Safe wind speed for Unfilled Panel)

(b) Filled GFRG Panels:-

If the wind speed VZ exceeds the above limit, the panel needs to be filled with concrete and suitably reinforced. In the absence of any reinforcement, considering filled concrete of M20 Grade, (design moment capacity as 2.83 kN/m for filled panel from experimental verification)

0.6 (VZ)2 x3x(1/8)x 1.5 = 2.83x1000 Nm/m

VZ = 52.9 m/s

The capacity can be further enhanced by providing one or two rebars in the middle of each cavity. However as the bar location is close to the centroidal axis of the section, the enhancement in capacity may not be significant, for out of plane bending (Unlike in-plane bending)

DESIGN OF FLOOR SLAB/ROOF SLAB

As GFRG panels with ribs aligned in direction of bending possesses flexural strength, such panels can be used as flexural slab, whose strength can be significantly enhanced by embedding 'micro beams', filled with reinforced concrete (ref. Fig 8).

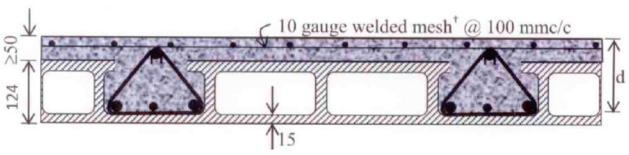


Fig. 8 : Typical Cross Section of Panel with Micro Beams

GFRG-RC composite slab systems can be used efficiently in floor slabs and roof slabs. The ribs are to be oriented along the shorter span, supported on GFRG wall panels. For convenience in design,

the contribution of GFRG towards flexural strength can be ignored and GFRG may be treated only as a formwork. Reinforced concrete micro beams are to be provided by filling cavities at regular intervals (typically every third cavity) and provided with reinforcement suitably designed, with a screed concrete of thickness not less than 50mm as shown in fig 8. One way slab action may be assumed for strength and deflection check. Such slabs can be conveniently designed up to spans of 5m.

GFRG PANEL AS PITCHED (SLOPE) ROOFING ELEMENT

Unfilled GFRG panels can be used as pitched roofs for single storeyed small span buildings, which are commonly adopted for low income group housing as shown in fig 9. Live load on roof is taken as 0.65 kN/m2 (On projected plan area). It is assumed that water repellent paint is applied on the top of the roof as in the case of external surface of the building wall panels. The roof panels are assumed to be integrally connected with wall panels. By carrying out various experiments and finite element analysis, it is seen that the maximum design moment parallel to the rib is less than the design moment capacity of 1.4 kN/m and the maximum design moment perpendicular to the rib is less than the corresponding design moment capacity of 0.59 kN/m. This means that panels can be used as sloping roof without any reinforced concrete filling.

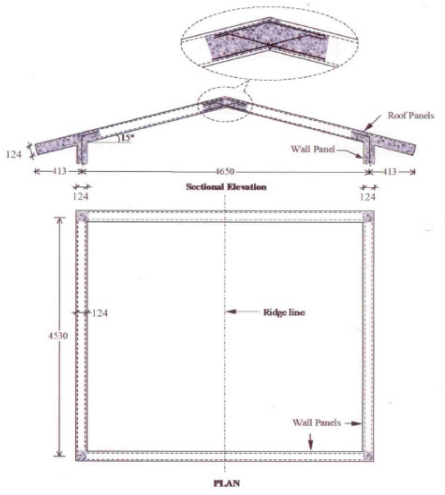


Fig. 9 :Typical Unfilled GFRG Pitched Roof

ANALYSIS AND DESIGN OF A TYPICAL MULTI-STOREYED BUILDING

A typical plan of an 8-storey apartment complex planned to be constructed in Mumbai (Zone-III) is considered here for demonstration. It is to be designed for earth quake loads as per IS-1893 (Part I) 2002. Fig 10 shows the plan of a typical block of apartment building. The building is to be founded on a sandy soil with a bearing capacity of 300 kN/m2 at a depth of 1.5 m below ground level. The various loads considered for analysis is as follows:

(a) The dead load of the entire walls and slabs are taken from the unit weight of the materials. The live load on the floor is taken as 2 kN/m2 (IS 875-2003, Part II).

(b) Wind Load: - Basic wind speed (Vb)-44 m/s

Risk coefficient (k1) - 1.0

Terrain height and structure factor k2 - 1.07

Topography Factor, k3 - 1.0

Design Wind Speed (Vz) = Vb.k1.k2.k3
= 47.08 m/s

Height of Building = 24m

Design Wind Pressure, 0.6 VZ2 = 1.33 Kn/m2

(c) Seismic Load:- Horizontal Seismic Coefficient, Ah= (Z/2)*(I/R)*(Sa/g)

= 0.16x1x2.50/(2x3) = 0.067

The details of the time period, base shear and storey lateral forces are tabulated in table 2.

Table 2 : Summary of Lateral Force Calculation

Direction	X	Y
Time period	0.57s	0.51s
Base shear (kN) V_B	1114	1166
Storey level	Lateral force distribution along X (kN) Q_{ix}	Lateral force distribution along Y (kN) Q_{iy}
1	6	6
2	22	23
3	50	52
4	89	93
5	139	146
6	203	212
7	273	286
8	332	348

The above mentioned example is typically suited for urban area where land availability is difficult and land prices are at premium. The option of going vertical has to be weighed with other services like lift, water and electric supply. The GFRG option gives us economy and speed which are the key parameters of PMAY program.

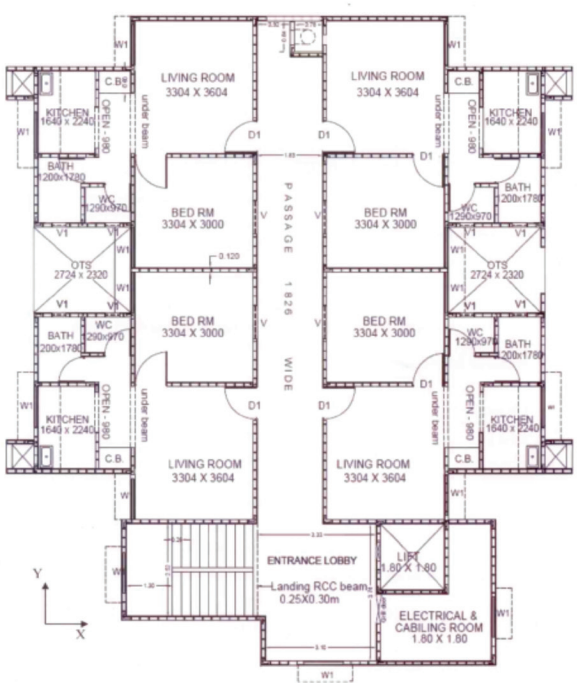


Fig.10 : Plan of Typical Floor of 8 Storey Building

CONCLUSION

PMAY (Gramin) and PMAY (Urban) are flagship programmes of ministry of rural development and Ministry of Housing & Urban Poverty Alleviation which aim to provide housing for all by 2022. To achieve the objectives within the limited time frame, the planning has to be fool proof and the technology adopted has to executable. Our cities are rapidly growing and any mass housing programme in urban area has to consider the rising cost of land and labour. Public private partnership is the need of the hour with proper accountability. Glass Fiber Reinforced Gypsum panels are one of the options available to us to economize the construction in urban region. There are other methods like using Pre Fabricated steel structures and composite structures. The ministry of rural development in collaboration with United Nations Development Programme and IIT, Delhi has carried out in depth study in the 18 states of India and had developed 130 zone specific comfortable, affordable, green and multi-hazard safe designs for the PMAY(G). A number of region-specific technologies have been developed based on local materials and traditional construction practices, which are less costly and more environment friendly than brick, cement, and steel intensive systems. In a vast and diverse country like India, the 'Housing for All' dream can be only achieved through tailor made solutions. A 'fit for all' design might not work considering the diverse geographic and climatic conditions. As engineers and technocrats our endeavor should be to develop technology which are green, cost effective and time saving to achieve this great and noble cause of providing a shelter to our fellow citizens.

ROLE OF ARCHITECTS AND TECHNOLOGY IN HOUSING FOR ALL

Dr. Oscar Concessao* and Dr. Ponni M. Concessao*

Abstract

Is it possible for the present Government to provide houses to all by 2022? Can the shortage of housing units in the country be overcome in a cost-effective manner?

India is facing an acute housing shortage to the tune of 25 million. 98 % of this is comprised by families of the weaker and low income groups, whose actual incomes make it impossible for them to own even the cheapest available housing unit, given the soaring housing market. When designing and building affordable housing, the importance of a healthy affordable housing partnership between architects and real estate developers cannot be overstated. Given the complexity of the affordable housing development process involving community needs, sustainable design, numerous location considerations, government approvals and many other critical details, teamwork on these projects is essential to ensure their ultimate success.

Architects can raise the value and lower the long-term costs of affordable housing projects. Good design is powerful, too. Well-designed projects also can boost developers' reputations. The Indian real estate sector has made progress by leaps and bounds so far but it needs to adopt technology to advance further, especially in the affordable housing segment. There is a collective belief in the Indian real estate market that technology can help create affordable housing.

INTRODUCTION

Developers usually call architects late in the development process, even though it would be to their and their projects' benefit to work with an experienced architecture firm from the start, especially during the pre-development phase. Design should not be an afterthought. Architects experienced in affordable housing can provide the best design possible, expedite the permit approvals and help developers avoid numerous project-related problems and obstacles.

An experienced architecture firm has intimate knowledge of the local permit process, zoning restrictions, building codes and environmental concerns, as well as connections and strong relationships with key administrators in agencies and planning boards. These connections are especially valuable to developers and investors. Architecture firms that wish to collaborate with developers need to be invested in improving communities. A reputation for having good and productive relationships with the local agencies can only help move the projects forward.

CAN'T WE ALL GET ALONG?

Traditionally, architects and developers have been at odds with each other, with each side feeling misunderstood or undervalued by the other side, and with both pushing and pulling and locking horns as a result. Ironically, these conflicted relationships-along with economic, social, political and cultural forces are fundamental to the shaping of a city. After all, what is ambition without creativity? And what is creativity without ambition?

But times are changing. A growing number of architects are teaming with real estate developers, while more developers are realizing that architecture is more than a marketing tool or the icing on the

* *Consulting Architects, Chennai*

cake of a project, understanding the true value of good design and the solutions it offers. Architects can raise the value and lower the long-term costs of affordable housing projects.

Good design is powerful, too. Well-designed projects also can boost developers' reputations. Furthermore, affordable housing being developed nowadays looks very different from the boxy public housing projects built decades ago. Today's affordable apartments and homes are more stylish and winning design awards. These buildings are conceived by architects who understand that housing is more than columns and walls-affordable housing is a community asset.

MUTUALLY BENEFICIAL PARTNERSHIPS

An ideal partnership benefits all partners, and the resulting alliance is stronger than its individual parts. Well-crafted partnerships rely on the strengths of each partner and provide opportunities to share costs, risks, and rewards. Affordable housing developers routinely partner with a variety of different organizations, from government agencies to community development corporations to architecture firms. These partnerships give developers access to talent and experience relevant to their projects. Whether you are an architect or a developer, a partnership that grows out of a shared vision, provides support when needed and effectively resolves conflict can go a long way to ensure successful outcomes in affordable housing development.

REALTY INNOVATIONS

Timely delivery of properties is important for both builders and buyers. From the buyer's point of view, early possession of an apartment means early freedom from rent payments.

If the buyer is an investor, he can start earning rental income early. Also, once its project is complete, the builder can invest the capital in new projects and earn more profits.

"Given the requirement of 26.5 million affordable housing units in India and project execution challenges and shortage of human resources, the traditional 'brick and mortar' construction is giving way to prefab structures and materials. Prefab technologies can be used to build homes quickly and cost-effectively, especially as traditional construction costs continue to rise. As the cost of borrowing is steep and developers are facing a liquidity crunch, time means money. Prefab technology involves use of factory-manufactured components in buildings. Some commonly used prefab materials include steel frames for structures, panels made of wood, cement, gypsum and other materials for floors, walls and ceilings, factory-made doors, windows and ventilators.

In large construction projects, various modules of the structure are cast off-site in factories and then assembled on the site. In the process, prefab materials such as wall and terrace blocks, wall panels, steel frames and plaster boards are used along with innovations such as the dry-wall technique. In prefab technology, the entire building can be designed using architecture software. Later, components such as steel frames, wall and ceiling panels and floor tiles can be custom-made. The components are then brought to the construction site and the structure is assembled on-site. Houses using steel frames for structure can have multiple stories without pillars, beams and concrete. Alternatively, the main structure and outer walls can be constructed using the conventional techniques and inside partitioning and interiors done with prefab materials.

STRONG FOUNDATION

Developers have already started using prefab materials in buildings such as using pre-fabricated concrete panels as shear walls and roof slabs, which are assembled like Lego blocks. Apart from prefab panels, complete kitchen and bathroom units are also being assembled as separate units with complete electrical and plumbing systems. These kitchen and bathroom 'pods' are then fit into place. "Prefab construction reduces construction time and improves the quality of the building. Though prefab materials are 15-20% expensive than the traditional ones, higher efficiency and less wastage and labor

costs can bring down the overall cost substantially for large buildings. They also eliminate the need for auxiliary activities such as plastering, electrical wiring and plumbing as these are done at the casting stage itself. The use of prefab techniques can also result in better cost efficiencies over the life span of the buildings.

GROWTH POTENTIAL

Pre-fabricated construction is not entirely new to the Indian construction space. Office and commercial buildings have been using prefab wall panels, ceiling panels, plasterboards and flooring systems to create interiors of offices and other places such as hospitals. Prefab panels and boards are eight-ten times lighter than brick-and-mortar walls. This reduces the load on the structure, which lowers the building cost. The use of prefab materials gives the option of customizing buildings for specific needs such as fire and water resistance and sound-proofing. Most of the demand for prefab materials is from large developers and for commercial spaces such as offices. Use by individuals for their homes is yet to gain popularity.

Individual home owners will become comfortable with prefab construction when they see it over a period of time in offices and commercial spaces. Individuals need to be sure about the viability of the technology before they are ready for the transition from the conventional method. In the West, only prefab materials are used in construction. Experts say prefab construction techniques, quite common in developed countries, will become popular in India too.

The use of pre-fabricated materials and methods is on the rise in the US as the construction industry has begun to adapt to changing market conditions, new materials and methodologies. Within India, one of the greatest obstacles is within the construction industry-the long periods for which projects are stuck, with delays in the supply chain. Off-site fabrication can reduce delays, free up the supply chain and help projects move ahead more rapidly. Rising demand for housing and improvement in techniques will increase acceptance.

As building inventories with developers become bigger, delivery becomes a priority and skilled labor replaces unskilled labor. Who knows factory-made houses might soon become common across the country, providing affordable as well as luxury homes to lakhs of families. Or, the next time you relocate, you might be able to hire a transporter to move your entire house to a new city.

To speed up construction of houses under Pradhan Mantri Awas Yojana (Urban), Prime Minister Narendra Modi has asked the central ministry for urban development, housing and urban poverty alleviation to look at 3D construction technology in 25 major cities. According to a few officials aware of developments in the meeting, the Prime Minister has asked the central ministry for urban development to organize a workshop with various stakeholders, including Indian and global companies associated with 3D construction, to promote this new technology. Through 3D technology, the pace of construction can be increased as it is based on pre-programming. Currently, approximately 1.25 lakh houses under the urban housing mission are being built using pre-fabricated technologies. The government believes that the use of 3D technology will not only speed up the process of construction but also reduce cost.

The central government launched Pradhan Mantri Awas Yojana (Urban) in 2015 to ensure housing for all by 2022. So far the government has approved the construction of over 20 lakh houses spread across 4,700 cities and towns. The government has set a target to construct 200 million houses.

Fig. 1: Slum Rehabilitation

AFFORDABILITY

The real estate industry is required to be innovative in dealing the global housing affordability disaster, while discussing effective implementation of the sustainable development goals. Worldwide, governments have failed to solve the affordability issue, and it is now up to the five Ps (Planet, People, Public and Private Partnership) to help find solutions. The Affordability Working Group explored the affordability challenge and solutions from several perspectives:

- The need to adopt a holistic view of affordable housing, implying community thinking and adequate infrastructure (physical and non-physical) rather than from a stand-alone basis, taking into account economic, social, environmental and cultural sustainability. This systemic thinking needs to be championed by system leaders who engage all stakeholders to be part of the solution.
- The role of technology in driving affordability while reducing negative impact on employment. Technology will play a bigger role in reducing cost/time of construction enabling mass production of affordable houses that are sustainable. Evolving technologies like 3D printing, BIM, Adidtaz and others are worth using to drive affordability. Citizen-driven approaches are an important part of this and by using technology, citizen voices will be heard.
- Planning high-density affordable housing is an important new direction rather than horizontal expansion that eats up land, which is the most costly element.
- Capital efficiency and design rethinking in driving affordability of homes, using design, value engineering and other tools to cut costs throughout the project life cycle. Innovative solutions throughout life cycle stages of the construction projects are important to achieving affordability.
- Innovative financing for affordable housing such as crowd funding and public-private partnerships in making affordability projects successful are important factors to be integrated in the affordability strategy

India is on the cusp of global dominance as it surges ahead as an emerging market. With this context, various sectors that fuel the country's economy need to adapt to modern, cutting-edge transformations that are rooted in technological innovations. A crucial sector that needs to ring in technological advancement is real estate. A number of key reasons such as rapid urbanization, a growing young demographic and mass migration to cities has fuelled the expansion of this industry.

To add to this the Central Government has initiated policies such as the Smart Cities Mission and Housing for all by 2020. These policies will add to the demand for homes in the country. Real estate developers and companies however must comprehend an important fact that quantity needs to be coupled with quality to render fruitful results.

Affordable housing, therefore, is a sector that calls for urgent technological enhancement. Targeted specifically to groups that comprise the Economically Weaker Section (EWS) and Low Income Group (LIG) of the society, a KPMG report suggested that this sector is set to account for 85 to 90 per cent of the total residential development, leading to a demand for 40-45 million housing units by 2028.

Technology also comes to the rescue of developers of mass housing projects that required huge investments and demanded long timelines for completion. Blending in new technology helps developers to improve the quality of construction, while shortening a project's construction time significantly. Some path-breaking technologies that have spruced up the construction space in real estate include precast, hollow pre-fab, block masonry, plasswall, and use of steel reinforced expanded polystyrene concrete panels as load bearing walls, Mivan formwork and use of bio-enzyme for sub grade improvement in internal road construction.

Technology enables sustainable designs in various ways. Precast technology, for instance, apart from reducing the duration of construction, cost and improving the quality of the final output is versatile and durable. Precast is produced only under strict quality measures in a factory by highly trained professionals with little wastage. Precast panels can be swiftly erected on the job site with negligible disruption and the precast thermal mass not only saves energy but also makes it possible for designers to cut down on heating and air conditioning costs associated with HVAC systems and at the same time, keep building occupants comfortable. Furthermore, the technology is adaptable to all types of constructions including high-rises, low-rises, commercial projects, villas, luxury projects and parking lots. An added benefit in this technology is its quality of being low-maintenance and being earthquake proof –which adds to the turnover of the project where this technology has been applied.

Innovative construction methods that are infused with technological advancements will help fulfill the requirement for homes being built for millennials in the long run. An example of this change is the shift from 2D to 3D pre-cast technology which has further enhanced the construction experience. Using 3D or volumetric construction, has made it easier to build service-intensive building elements such as 'pod' kitchens and offers improved air tightness. An advantage of 3D precast is the ability to create bespoke interiors that suit a discerning buyer's preferences.

Technology can also aid in enabling eco-friendly construction. Millennials are increasingly aware of the changing environment and a prefer buying projects that have a low carbon footprint. Developers are careful to follow the highest green standards, which involves design and architecture, water conservation, use of renewable energy, and sewage and garbage processing. Technology is employed suitably in every basic amenity in a home that aims at carbon neutrality – be it the design of toilets that uses minimal water in flushing, plumbing that makes provisions for separate lines for drinking and flushing, used water treatment for gardening, efficient insulation in the walls, ceilings and floors enables better temperature control among others.

In a modern economy like India where the millennials are armed with increasing disposable income, real estate is seen as a lucrative long-term investment. From owning a home in the city to second home villas in picturesque locales, these unbridled aspirations fuel the dreams of many. Developers have to understand that the buying decisions of this demographic are influenced by the kind of technology that has been used in constructing the property. Establishing technology enabled constructions processes in projects will help developers build efficiently for millennials in India, while saving costs and fulfilling demands in a timely manner.

RISKS OF 3D PRINTED HOUSES TO THE JOB MARKET

Currently, the construction of homes in the UK and US is one of the most labor-intensive areas of the economy. It is estimated that, in the UK alone, 2.1 million people are employed within the Construction sector. Across the globe, this figure is around 110 million. The advent of 3D printed houses promises better, cheaper homes that are constructed faster and with improved accuracy.

At the moment, the construction of 3D printed houses isn't a fully automated process. Human labor is still an essential part of the building site, as well as back offices, and of course on the design and project management front, and so on. At ground-level, 3D printers build only the structure's walls. Human labor is still required to install fittings, such as doors and windows. That is, for now. It's not hard to imagine that 3D printers will be able to handle multiple materials, and robotic 'workers' will be able to install the fixtures far quicker.

With the advent of 3D printed architecture, bounds of architectural creativity are widened exponentially. Intelligent software developments, combined with the increasing dexterity of 3D printing technology, will allow architects, designers, and homebuilders, the freedom to create ever more

inspiring buildings for the future. The savings that the Construction industry can expect from a more automated construction process are certain to create increased profits. Machines can work longer hours, require no breaks, and aside from routine maintenance and parts cost less to employ.

The reduced cost of materials and labor required to construct 3D printed houses will have the welcome benefit of a home that is much cheaper to build. The question, however, of whether this decreased cost will be reflected in the residential property market, remains. If human workers increasingly find themselves ousted by technological advancement, such as in the case of 3D printed houses, unemployment rates will rise.

3D printers and robotic construction equipment, combined with the high-skill labor of architects, programmers and so forth, will be forced to build only those large-scale homes that are in demand at the top end of the market.

New Age Technologies in Construction Industry Key to Achieve Housing for All by 2022

Many private developers are already using new age technologies that provide a boost to affordable housing. The construction industry is rapidly changing and new materials, construction technologies are being introduced on a regular basis. Execution of construction projects and their delivery in a timely manner has become a prime concern for developers in view of the buyer's agitation on delay in construction. Especially after RERA, which emphasizes the need of timely completion of projects, adoption of modern technologies has become the need of the hour for a developer to survive in the market.

CONCLUSION

"Housing for All" to achieve the ambitious goal of it is imperative to adopt newer technologies at a much faster pace. Adoption of such technologies will not only reduce the turnaround time but also improve the quality and durability of construction and help in generating more interest in affordable housing projects among buyers.

Rising industrial, residential and commercial growth is driving the demand for faster construction and world class quality. It has become imperative to use newer products and technologies to meet this increasing demand. The construction industry in India is at the cusp of disruptive change with new materials, building technology, software, digitization and artificial intelligence changing the way we conceptualize, build and use our buildings.

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PREFAB CONSTRUCTION FOR MASS HOUSING PROJECTS - THE WAY FORWARD

Dr. Mahesh Kumar*

Abstract

Prefabrication is the practice of assembling components of a structure in a factory or other manufacturing site, and transporting complete assemblies or sub-assemblies to the construction site where the structure is to be located. The term is used to distinguish this process from the more conventional construction practice of transporting the basic materials to the construction site where all assembly is carried out.

This paper presents salient features of prefab technology along with its advantages and disadvantages. Based on the benefit and potential, technology adaption for mass housing project can be done.

INTRODUCTION

Over the centuries, man in his quest for constructing a safe home on resisting and overcoming the forces of nature, made rapid changes in selecting various effective construction materials, mode of construction, considering all demographical conditions.

Now with all various complexities arising due to the increased population, fulfilling the demand for housing has posed a big challenge in India. With the program and emphasis on Housing for all the state of art of adopting multiple technologies has paved the way to solve the housing demand of the country.

The design concept of the precast buildings is based on the build ability, economy and standardization of precast components.

In design of precast members and connections, all loading and restraint conditions from casting to end use of the structure should be considered. The stresses developed in precast elements during the period from casting to final connection may be more critical than the service load stresses. Special attention should be given to the methods of stripping, storing, transporting, and erecting precast elements.

When precast members are incorporated into a structural system, the forces and deformations occurring in and adjacent to connections (in adjoining members and in the entire structure) should be considered. The structural behavior of precast elements may differ substantially from that of similar members that are monolithically cast in place.

Design of connections to transmit forces due to shrinkage, creep, temperature change, elastic deformation, wind forces, and earthquake forces require special attention. Details of such connections are especially important to ensure adequate performance of precast structures.

Precast members and connections should be designed to meet tolerance requirements. The behaviour of precast members and connections is sensitive to tolerances. Design should provide for the effects of adverse combinations of fabrication and erection tolerances.

Tolerance requirements should be listed on contract documents, and may be specified by reference to accepted standards. Tolerances that deviate from accepted standards should be so indicated

Engineer Member, DDA & former E in C Haryana PWD&MD, Haryana Roads & Bridges Devp. Corp.

Prefab Technology consists of construction of structural members in factory yard and to assemble them at site. Depending upon the project, construction technology may be combination of both cast in situ and prefabrication or it may be more prefabricated. While there may be numerous variations in method of construction. Here it is a case study of one of the methods adopted in DDA housing projects.

METHODOLOGY

In this project, foundation is laid with conventional methods and superstructure is framed in precast dense concrete. This system incorporates precast dense reinforced cement concrete hollow core columns, structural RCC walls, beams, stairs, floor/roof solid slabs, lintels, parapets and chajjas. Autoclaved Aerated concrete (AAC) blocks are used for partition walls. Hollow core columns are erected above cast-in-situ substructure, over which beams are integrated in the column notches followed by erection of slabs. Structural continuity and robustness is achieved through wet jointing using dowel bars, continuity reinforcement placed at connections and filling the in-situ self-compacting concrete in hollow cores of columns, beam and slab tops. All the connections and jointing of various structural framing components is accomplished through in situ self-compacting concrete along with secured embedded reinforcement of appropriate diameter, length and configuration conforming to earthquake resistant design in order to ensure monolithic, continuous, resilient, ductile and durable behaviour. Structural components i.e. slab walls, columns and beams are manufactured at site factory or casting yard.

The structural system for the buildings consist of "DUAL SYSTEM" i.e. moment resisting reinforced cement concrete frames with shear walls constructed using precast structural elements; joined with in situ self-compacting concrete (Fig. 1 to 4). All frames are tied at every floor with prefabricated composite RCC slab having topping of 55 mm thick reinforced concrete screed, acting as a rigid horizontal diaphragm. The column beam joint are rigid joints and are detailed accordingly. The lateral forces are transferred to the shear walls and column- beam frame through infinitely rigid slab-beam diaphragm.

It needs a state of art factory for manufacturing precast components. The factory, laid over 25,200 sqm area with storage / stacking area of 46,000 sqm for precast components. The overall production capacity of this factory is as under:

- Precast Columns = 132 nos / day
- Precast Beams = 520 nos / day
- Precast wall panels = 250 nos / day
- Precast slabs = 463nos / day
- Precast Rakers = 9 nos / day
- Lift core units = 16 nos /day
- Precast parapet walls = 35 nos / day
- Miscellaneous components viz; precast panels, chajjas etc. = 136 nos / day

SALIENT FEATURES OF THE PROJECT

The Housing blocks, have been combined to form open cluster court pattern, and are easily identifiable to inhabitants as their zone (mohalla) in a large site establishing a sense of micro territoriality. Such open clusters essentially in turn focus to the central green areas already established at zonal level plan. Also, as principle, all the buildings are having access from the pavements of vehicular roads, with vehicular roads running on at least two sides. The courtyard side have pedestrian path along the building with lift entrance areas accentuated with wider plaza.

All the pedestrian streets are connected directly to the vehicular roads. A peripheral vehicular ring has been proposed with several cul-de-sacs located strategically where vehicular access goes deeper in the site thus enabling to keep the site core essentially vehicular hazard free, and easing pedestrian connectivity. Community needs such as community hall, crèche, reading room, senior citizen's room has been proposed in a separate block centrally located. The shops for daily needs are also combined in this block.

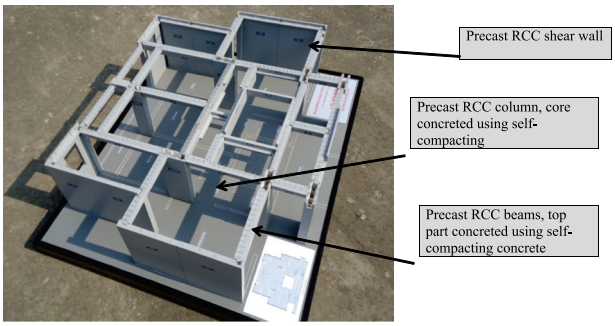

Fig. 1: Model Depicting Prefab System

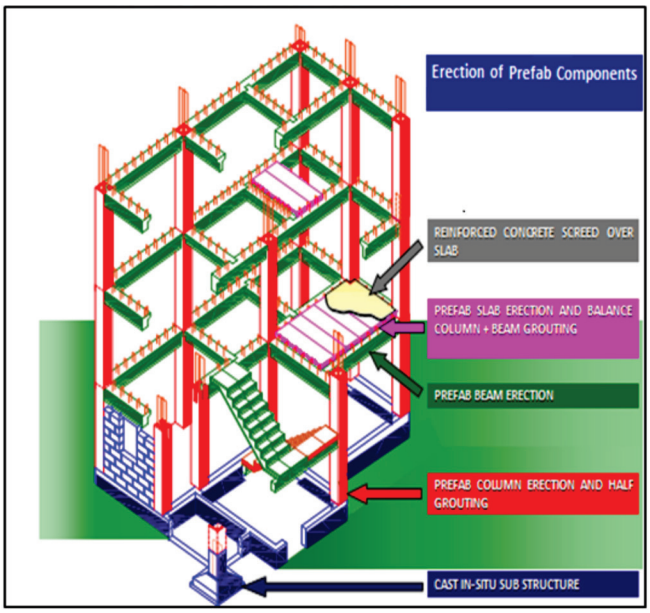

Fig. 2 : Model depicting Prefab System

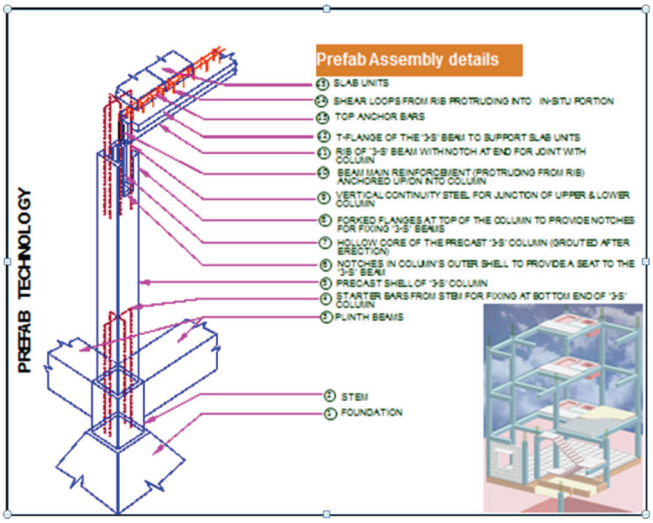

Fig. 3 : Model depicting Prefab System

Fig. 4 : Model depicting Prefab System

Green Building Concepts

Conservation of national resources and maintaining ecological balance is a national necessity. The technology adopted is keeping in mind the need for conservation of fast depleting natural resources, environment protection, ecological balance and sustainable development in line with the concept of green building. These are achieved through:

- Reduction in dead weight due to light weight prefab components which is beneficial from seismic considerations.
- Substantial reduction of concrete and steel per unit of built up area due to use of prefab construction.
- Considerable reduction in quantities of natural resources such as sand, metal, water, wood etc. by optimum utilization of construction materials.
- Use of industrial waste like fly ash in concrete, which enhances sustainability.
- Due to use of precast structural members, construction time required for each floor is reduced substantially.
- Elimination of plaster to precast units such as slab, wall panel etc., since these components are form finished.
- Total elimination of timber / wood for both shuttering and doors due to use of reusable

steel moulds and prefabricated G.I door systems.

- Uses of light weight AAC blocks for interior walls affording thermal and acoustic insulation along with enhanced fire protection.
- Use of recycled water from STP for flushing.
- Rain water harvesting system comprising of recharge pits with grease trap chambers.

Thermal and Weather Comfort

The habitat rooms of residential dwellings are specially designed to impart required thermal comfort to end occupants during varied temperature conditions, as prevalent at Delhi. Special considerations are given to varying temperatures (5 C to 51 C) while selecting construction material for those surfaces from which considerable thermal moment occurs.

Earthquake Resistant Structural Design

Earthquake forces are calculated in accordance with IS 1893and IS 1893 (Part1). Appropriate percentage of imposed load is considered for calculating seismic weights and seismic forces. Rigid horizontal diaphragm action is considered so that the storey deflection at all nodes in the storey is almost same.

3-D dynamic analysis using Response Spectrum Method is performed for proposed building since the buildings are situated in zone IV as per clause no 7.8.1 (a) of IS 1893 (Part1). There is a general concern regarding the seismic performance of precast construction. It is noticed that large panel construction performs better than frame system.

However, in areas of high seismic risk, structures must be designed to respond safely to the dynamic forces imparted into the structure. Innovations in joint design are improving the connection systems in precast concrete structures and making them increasingly suitable for use in such areas.

Design of the connections in precast elements under seismic actions should account for :

- Strength
- Ductility
- Energy dissipation capacity
- Deformation Limit
- Strength decay under cyclic loading
- Large residual deformations

Safety Against Progressive Collapse

All applicable precautions as laid down in IS: 15916 and IS: 15917 are to be taken in the designs and detailing of proposed prefabricated buildings.

Fire Protection

All structural floor elements are designed for1 hour fire rating and all vertical load bearing structural elements are designed for 2 hour fire rating as per relevant applicable provisions of IS:456 and IS:1642. Accordingly, member sizes and cover to reinforcement is maintained.

Fire-fighting installations of the housing schemes are as per latest National Building Code (NBC) and CPWD specifications. The clearance is obtained from Delhi Fire Service (DFS).

High Level of Mechanization / Automation

One of the most unique features of the project is the high degree of mechanization and automation achieved on the project. The most important activity on the project is that of precast reinforced concrete structure which is entirely mechanized. All the precast structural components are manufactured in a fully mechanized plant with minimal human labour input. Right from dispatch of concrete from the batching plant through an overhead concrete shuttle which delivers concrete to the "Comcaster" which in turn lays the concrete into the column / wall / slab / moulds which already have the required reinforcement steel in place.

An automated and programmable reinforcement cage manufacturing unit capable of handling 150 tons of steel per day had also been installed. The entire structural component manufacturing facility was supported by high quality compaction and vibration stations, surface finishing equipments and high capacity overhead cranes, lifting and tilting stations etc. After concreting of the precast components in robotic moulds, components undergo an accelerated curing process in specially designed curing chambers which ensures that the concrete components achieve their design strength which in turn enables handling of the precast components within a short period of 8 hours. Besides this, accelerated curing of beam was achieved through hot water pipes concealed in the beam moulds. This ensures de-shuttering of moulds in shortest possible time, thereby leading to optimum utilization of moulds. The water used for accelerated curing is recycled during the entire operation in the plant resulting in substantial saving due to zero wastage of water as compared to conventional construction. Further the components are lifted, shifted and erected at site by totally mechanical means. A total of 60 tower cranes and 2 mobile cranes accompanied by a large number of small cranes (hydra) were pressed in service for erection of precast components. Fig. 5 to 8 shows the manufactured components and Fig.9 shows the completed buildings.

Fig. 5: Reinforcement Processing Plant

Fig. 6: Manufacturing of Precast Wall Panels

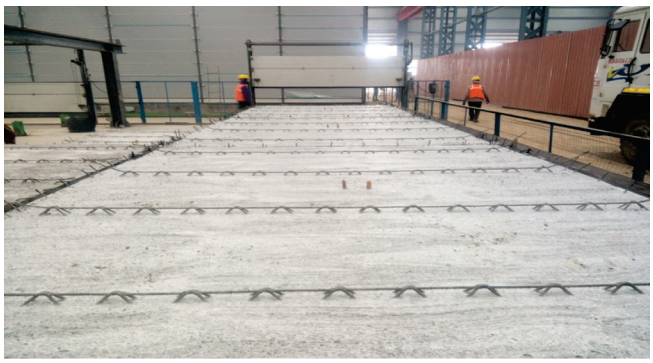

Fig. 7: Manufactured & Ready to Shift Precast Half Slabs with Lattice Girders

Fig. 8: Erection of Precast Components

Fig. 9 : A View of Completed Buildings

TYPES OF PRECAST SYSTEMS

Depending on the load-bearing structure, precast systems can be divided into the following categories:

- Large-panel systems
- Frame systems
- Slab-column systems with walls
- Mixed systems

Large Panel Systems

The designation "large-panel system" refers to multistory structures composed of large wall and floor concrete panels connected in the vertical and horizontal directions so that the wall panels enclose appropriate spaces for the rooms within a building. These panels form a box-like structure. Both vertical and horizontal panels resist gravity load. Wall panels are usually one storey high. Horizontal floor and roof panels span either as one-way or two-way slabs. When properly joined together, these horizontal elements act as diaphragms that transfer the lateral loads to the walls.

Depending on wall layout, there are three basic configurations of large-panel buildings:

- Cross-wall systems
- Longitudinal wall systems
- Two-way systems

Frame Systems

Precast frames can be constructed using either linear elements or spatial beam column sub-assemblages. Precast beam-column sub-assemblages have the advantage that the connecting faces between the sub-assemblages can be placed away from the critical frame regions; however, linear elements are generally preferred because of the difficulties associated with forming, handling, and erecting spatial elements. The use of linear elements generally means placing the connecting faces at the beam-column junctions. The beams can be seated on corbels at the columns, for ease of construction and to aid the shear transfer from the beam to the column. The beam-column joints accomplished in this way are hinged. However, rigid beam-column connections are used in some cases, when the continuity of longitudinal reinforcement through the beam-column joint needs to be ensured.

Slab-Column Systems with Shear Walls

These systems rely on shear walls to sustain lateral load effects, whereas the Slab-column structure resists mainly gravity loads. There are two main systems in this category:

- Lift-slab system with walls
- Prestressed slab-column system

In the Lift – slab system, the load-bearing structure consists of precast reinforced concrete columns and slabs. Precast columns are usually two stories high. All precast structural elements are assembled by means of special joints. Reinforced concrete slabs are poured on the ground in forms, one on top of the other. Precast concrete floor slabs are lifted from the ground up to the final height by lifting cranes. The slab panels are lifted to the top of the column and then moved downwards to the final position. Temporary supports are used to keep the slabs in the position until the connection with the columns has been achieved.

The prestressed slab-column system uses horizontal prestressing in two orthogonal directions to achieve continuity. The precast concrete column elements are 1to 3 stories high. The reinforced concrete floor slabs fit the clear span between columns. After erecting the slabs and columns of a story, the columns and floor slabs are prestressed by means of prestressing tendons that pass through ducts in the columns at the floor level and along the gaps left between adjacent slabs. After prestressing, the gaps between the slabs are filled with in-situ concrete and the tendons then become bonded with the spans. Seismic loads are resisted mainly by the shear walls (precast or cast-in-place) positioned between the columns at appropriate locations.

Mixed Systems

In this system we can adopt combination of details given above

SHOP DRAWINGS

All details of reinforcement, connections, bearing elements, inserts, anchors, concrete cover, openings and lifting devices, and specified strength of concrete at critical stages of fabrication and construction, should be shown on either the contract documents prepared by the architect/engineer of record or on the shop drawings furnished by the contractor. Whether this information is to be shown on the contract documents or shop drawings depends on the provisions of the contract documents. The shop drawings should show, as a minimum, all details of the precast concrete members and embedded items. The contract documents may specify that portions of connections exterior to the member are also to be shown on the shop drawings. The contract documents may also require the contractor to provide designs for the members and/or connections.

The contract documents should show the loads to be considered in design of the precast concrete elements of the structure, and they should indicate any special requirements or functions (for example: seismic loads, allowance for movements, etc.) that should be considered in design assigned to the contractor. In this case, the shop drawings should include complete details of the connections involved.

ADVANTAGES

- Moving partial assemblies from a factory often costs less than moving pre-production resources to each site.
- Deploying resources on-site can add costs; prefabricating assemblies can save costs by reducing on-site work.
- Factory tools - jigs, cranes, conveyors, etc - can make production faster and more precise.
- Factory tools - shake tables, hydraulic testers, etc - can offer added quality assurance.
- Consistent indoor environments of factories eliminate most impacts of weather on production.
- Cranes and reusable factory supports can allow shapes and sequences without expensive on-site formwork.
- Higher-precision factory tools can aid more controlled movement of building heat and air, for lower energy consumption and healthier buildings.
- Factory production can facilitate more optimal materials usage, recycling, noise capture, dust capture, etc.
- Machine-mediated parts movement and freedom from wind and rain can improve construction safety.
- It reduces impact of construction at building sites. As the staging area is significantly limited, on-site waste generation is reduced on account of most of the construction taking place at an off-site location.

DEMERITS

- Transportation costs may be higher for voluminous prefabricated sections than for their constituent materials, which can often be packed more densely.
- Large prefabricated sections may require heavy-duty cranes and precision measurement and handling to place in position.
- Proper Joint between different members requires precise and careful supervision.

CONCLUSION

As the Indian economy shifts towards services located in urban areas and a growing middle class, with an anticipated 40% of the country's population inhabiting cities by 2020, it is essential to have an

integrated and synergistic approach to sustainable construction. Protection and conservation of natural resources while reducing energy consumption levels and achieving particular standards in green ratings, should be a clear objective. To make this a reality it would be imperative to shape sustainable development criteria while considering cost efficiency parameters

Prefabrication saves engineering time on the construction site in civil engineering projects. Prefabricated elements and systems offer designers and contractors significant advantages in terms of construction time, safety, environmental impact, constructability, and cost. Therefore, by opting for prefabricated building solutions over traditionally constructed homes, one can achieve cost savings both in the short term and over the life of the structure. At the same time it helps reduce the impact of one's activities on the environment for the benefit of future generations. However, joints between different members require precise and careful supervision.

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HOUSING FOR ALL - A CASE STUDY OF INNOVATIVE TECHNOLOGY

N.C. JAIN*

Abstract

Timely delivery of properties is important for both builders and buyers. From the buyer's point of view, early possession of an apartment means early freedom from rent payments. If the buyer is an investor, he can start earning rental income early. Also, once its project is complete, the builder can invest the capital in new projects and earn more profits. "Given the requirement of 26.5 million affordable housing units in India and project execution challenges and shortage of human resources, the traditional 'brick and mortar' construction is giving way to innovative technologies for fast construction. In this paper a case study is given using aluminium formwork which has been adopted in a DDA mass housing project.

Aluminium formwork is an innovation in construction technology. It is cost effective, time saving and provide good quality monolithic structure. The basic element is the panel which is a frame work of extruded aluminium section welded to 4 mm aluminium sheet.

INTRODUCTION

At present, there is a huge shortage of 18.8 million houses across urban centres in India. Out of it, 15 million is in LIG category. It is expected that the annual demand for housing units in urban areas may reach 38.4 million units by 2022. Abreast of this problem, Prime Minster of India has announced two schemes namely Prime Minister's Awas Yojana (Urban) – Housing For All, and development of Smart Cities in different states. These missions envisions multitude of strategies to overcome the problem to a reasonable extent.

2508 cities in 26 States have been selected under Prime Minister's scheme for Affordable Houses. Many States have also announced 'Houses for All' schemes. Since there is huge gap between demand and supply, it calls for adoption of modern innovative construction technologies which can provide mass affordable houses with speed as well as quality. Construction of mass houses with with Aluminium Formwork Technology is one of the solutions.

CASE STUDY –DDA HOUSING PROJECT AT NARELA

Salient Features of the Project:

Name of the Project : DDA Housing Project at Narela Agency; Ahluwalia Contracts (I) Ltd. Estimated Cost of the Project : 338.96 Crores Plot Area :39292 Sqm

Number of Houses : EWS – 2020 – 4 Towers – G+24

CAT-II – 312 – 4 Towers – G+13

Covered Area of EWS unit : 32.92 Sqm

Covered Area of CAT-II unit : 82.23 Sqm

Basements: Two basements with total covered area of 23000 sqm.

Amenities: Community centres, shopping centre, children playgrounds, primary and secondary schools, ESSs, guard rooms. Finishes: Bathrooms and toilets have ceramic tiles up to ceiling height. Vitrified tiles are in all floors. Kitchen counter is provided with granite slab. Door frames are

* *Sr. Vice President, Ahluwalia Contracts (I) Ltd , New Delhi*

of powder coated G.I. sheets. Green marble all-round the widows' openings. All doors are flush doors. Three track powder coated aluminum windows. Lift lobbies have granite cladding.

Lifts: Since the towers are G+24 floors. 6 Lifts have been provided in each tower. Fire Alarm System: With the increase in height, fire alarm system has been necessarily provided.

External Development: Network of sewerage lines, water supply lines, fire fighting lines, storm water drainage, street lighting etc. is being placed in position.

Time Line: 30 months for complete construction work.

ALUMINIUM FORMWORK TECHNOLOGY

Aluminium Formwork is best suited for mass housing with typical floors where number of repetitions is more. This can achieve fast construction with high quality. This is highly suitable for load bearing structure. The basic element is the panel which is a framework of extruded aluminium section, welded to 4mm thick aluminium sheet. Panels are made from high strength aluminium alloy.

In this system, walls, columns, floor slabs, beams, stairs, balconies together with door and window opening are cast in place in a single operation. The resulting building structure is very strong, accurate in dimension and tolerances. With high quality of finished concrete surface, no further plastering is required.

Fig. 1 : EWS Block

Assembly and Erection of Aluminium Formwork

- Simplicity of Aluminium Formwork has greatly helped in accurately programming construction sequences at site.
- Since all panels received at site are clearly labeled, these have been smoothly fitted together using formwork modulation drawings.
- Vendor's technical guidance in assembling the formwork in the first two floors of the tower helped as the work force got trained at site.
- The following system for assembly and erection is being followed at site.

Pin and Wedge System

Basically in this system, panels are held together by a simple pin and wedge system that passes through holes in the outside rib of each panel. The system does not require any bracing.

Quick Strip Prop Head

Another important feature of the system is V shaped prop head which allows quick strip to take place leaving the props undisturbed. The deck panels can be used immediately. This has helped in expediting the progress of work.

Assembly and Erection Sequences

- Shifting and arranging the panels to the site of erection.

- Preparation for erection
- Erection of walls/ columns panels.
- Erection of slab length and slab in corner
- Erection of middle beam, end beam and prop head
- Erection of deck slabs panels.
- Erection of kicker plates.
- Erection of brackets

Fig. 2: Column Beam Slab Assembly Detail

ADVANTAGES OF ALUMINIUM FORM WORK

Some of the advantages as experienced in the project site are listed below:

- It has been very easy to handle the formwork and construction has been quite convenient and effective.
- It can be easily used up to 250 times.
- It has been cost effective. Initial cost is high but ultimate cost per sqft will be less compared to traditional methods.
- There is construction time saving. Typically 8-9 days cycle has been achieved in floor to floor construction.
- It is expected to have saving in overhead expenses also due to speedy construction.
- Structure being monolithic, it is crack free.
- Project has helped in saving the environment for not using timber or plywood for formwork.
- There was no need of starter for marking purposes. This is also a plus point.

Fig. 3: Completed Buildings

CONCLUSION

The results have been very encouraging. Both tangible and non-tangibles benefits have been achieved in the project. These can be summarized as follows:
Time Lines

The height of the Towers housing EWS houses has increased from G+7 as given in the agreement to G+ 24 when the drawings were finalized to accommodate all the houses as envisaged in the agreement within the available land.

With the use of Aluminium Formwork, towers with G+24 floors have been completed in 8 months' time i.e., average 3 floors per month as against 2 floors per month with traditional formwork.

With the increase in height from G+7 floors to G+24, the project has required for additional time of 12 months. However, with Aluminium formwork, project is likely to be completed in reasonable time. There is thus time saving of at least 8-9 months.

Quality

With Aluminium formwork, far superior quality has been achieved compared to the traditional formwork. The client is highly satisfied with the quality of work achieved with this system. It was

also first time experience with them. Also, unlike precast structure, there are no joints as the structure is monolithic. This adds to further advantage.

Cost

There is cost saving in the form work. Formwork area per floor for EWS houses is 2600 sqm and for CAT-II houses, it is 1600 sqm. The quantity of total formwork for the project as a whole is approx. 3,65,236sqm. The total cost of formwork including labour is likely to be about Rs 350 per sqm against the cost with normal formwork of Rs. 400-450 per sqm.

Further on completion of the project, the formwork can be reused in other housing projects. It is expected that70% of the members will be reused with or without any modifications. There is also salvage value of 30%. Thus, there are very visible cost benefit besides the savings in overall cost for early completion of the project.

NEW TECHNOLOGIES FOR AFFORDABLE HOUSING IN INDIA

Dr. J. Bhattacharjee*

Abstract

Housing inadequacy is largely felt in India at the level of low income and more so with continuous rise in cost of construction at all levels. This necessitates the use of appropriate and cost effective new technologies in housing construction. The use of conventional construction materials in the housing sector poses primarily two major problems, firstly they are comparatively costly and secondly they cause pollution and disturb the environmental balance. To overcome this, there is a need for developing cost effective, durable housing using new technologies, particularly keeping in mind the low income group and economically weaker sections of the population.

In this paper deliberation has been made to identify and discuss about various types of technological developments taken place for cost effective solutions, with overall focus on the need of common man. The present state of Housing and special needs of Urban India is also discussed. The existing various Govt. Housing Schemes to address this problem is also brought out in the paper.

INTRODUCTION

India is facing a housing shortage which is currently estimated to be more than twenty five million homes in the country, out of which, EWS (economically weaker sections) and LIG (lower income groups) account for 95%. In 2015, the Indian government launched the Housing for All mission with an aim to provide affordable housing to urban poor. It is proposed to build twenty million houses for the urban poor by the year 2022. To achieve this goal, the government and private real estate developers have to launch large scale affordable housing projects all over the country. However, the construction industry is facing issues with manpower shortage and rising cost of construction materials. The cost of labor has gone up significantly and availability of construction workers has become problematic. Furthermore, the pressure on developers has increased as customers are demanding on-time delivery of their homes with good quality construction work. Conventional construction methods is not able to exploit the advantages of mass housing and in the current scenario; it is evident that new construction technologies should be utilized to deliver homes fast with minimum labor and zero wastage of materials. Especially in Europe, after the Second World War, the housing shortage was solved by implementing new technologies like precast concrete construction. Precast concrete construction is a building method where building components are prefabricated off site on an assembly line using advanced tools and equipment and thereafter transported to the building site, where they are erected using building cranes. Precast concrete construction has evolved over the past five decades towards a flexible building technology, which is used in many infrastructure projects and building projects throughout the world.

OBJECTIVES

Our main objective is to tackle the needs of migrated people from rural to urban areas, essentially in search of job, which is the trend of day all over India. Due to rapid growth in the

*Prof. & Advisor, Amity University, Noida, & former Joint DG, MES

urban population, owning a house, which is a basic necessity, still remains a dream for many, in spite of several initiatives taken by the Govt. of India. While a number of programmes are being supported through Central and State Governments, banking sector, housing finance companies, cooperative initiatives, the houses remain in shortage and requirement particularly in urban areas continues to grow at a rapid pace, indicating the need for innovative and rapid measures to address the ever increasing demand. Constructing affordable houses with innovative technology within the reach of a common and middle income group at fast speed is one solution for providing roof to all in this era of diminishing resources and economy resulting into alarming hike in construction cost. Resolving housing shortages is a challenging job for country since at present conventional and traditional housing technologies are mostly used in actual construction and same is being taught in the engineering institutions. 'Housing for All' is the key issue of the day before the nation and, therefore, to implement this theme, the number of seminars/conferences is being arranged, where discussions are normally planned to be held on sub-themes, like comprehensive planning techniques, safety and quality of efficient and affordable housing; prefabrication plant and equipment's; role of CAD/STAAD and other computer applications in innovative concept and new technology; mass scale housing technologies; new affordable housing techniques and technologies; innovative building materials is essentially required for affordable housing.

The construction industry is rapidly changing and new materials, construction technologies are being introduced on a regular basis. Execution of construction projects and their delivery in a timely manner has become a prime concern for developers in view of the buyer's agitation on delay in construction. Especially after RERA, which emphasizes the need of timely completion of projects, adoption of modern technologies has become the need of the hour for a developer to survive in the market. As brought out earlier, around 2 million homes need to be built by 2022 to achieve the ambitious goal of the Modi government's 'Housing for All'. As per Colliers Research, to achieve such a huge objective, it is imperative to adopt newer technologies at a much faster pace. Adoption of such technologies will not only reduce the turnaround time but also improve the quality and durability of construction and help in generating more interest in affordable housing projects among buyers.Rising industrial, residential and commercial growth is driving the demand for faster construction and world class quality. It has become imperative to use newer products and technologies to meet this increasing demand. The construction industry in India is at the cusp of disruptive change with new materials, building technology, software, digitization and artificial intelligence changing the way we conceptualize, build and use our buildings.

Private developers are continuously exploring new technologies that improve the quality, strength and safety of the buildings. In metro cities, few developers have started using technologies such as self-climbing formwork, aluminum shuttering, precast concrete technology and dry wall systems. These technologies are not only cost-effective, but offer advantages such as minimal labour force, higher earthquake resistance, more durability than conventional building techniques, higher carpet area, smooth finish on walls and lower on maintenance.

Although aluminum shuttering technology increases the overall cost on construction, it reduces the construction time which will allow developers to start sales earlier than planned. In this era, where timely delivery of the project is one of the prime concerns owing to regulatory reforms, escalating construction costs and maintaining strength in the structure, these technologies are gaining popularity among developers. In conventional building

techniques, transportation of building material, such as bricks, wastage in materials during carriage and handling makes it expensive than aluminum shuttering techniques.

Precast construction technique is also popular not only among developers but also with the government. In Maharashtra, MHADA builds affordable housing using precast technique which is cost effective, speedy and easy to install than traditional building techniques. In precast concrete technology, building components such as columns, beams and slabs are cast in the factory and cured using autoclaving and transported to the construction site where these components are fixed and stacked into each other as per the layout design. Although some of these construction techniques are more expensive than the conventional construction methods, they reduce the construction time by almost 25-30%, allowing the building to be used earlier, thereby bringing cost advantage to the developer and the user.It is believed that with the rising demand for affordable housing in urban areas, policy reforms such as public private partnership, etc., provision for affordable housing projects and use of state-of-the-art construction techniques are likely to attract private developers as well. Many private developers are already using these technologies that provide a boost to affordable housing and will help achieve the target of 2 million homes by 2022.

AFFORDABLE HOUSING AND THE PRECAST TECHNOLOGY

The word affordable house itself meant for the people to buy houses at a reasonable price within their strength of income resources, it means the cost of construction and land must come down drastically compared to the current scenario. As far land is concerned Governments are providing lands for the Economically Weaker Section people, and also it is insisting dev-elopers to provide 10% of the building to EWS. But the million dollar question is the construction cost, as it can't come down drastically as it involves men, materials and machineries and the contractor has to allocate sufficient funds for all these activities. However, there is way to reduce the cost of construction using Precast Technology and by which it can make the EWS people to afford to have their own houses as they dreams.

One can see in all major cities of India, lakhs and lakhs of houses are unsold as the demand is so low and supply is plenty. This is mainly due to developers targeted the elite and higher middle-class sector people. Whereas, as per the Pradhan Mantri Awas Yojana (PMAY) scheme, there is demand for about 20 million housing units in rural and urban poor whose salaries ranges below 3.4 Lakhs p.a. If one keenly see the Indian income pyramid there are 56% of people, who have been classified as EWS and about 30% of people have been classified as LIG. It is the Government responsibility to provide houses for all citizens to meet out the demand for houses for EWS and LIG group of people, and this huge deficiencies can be met conveniently by using this Precast Technology.

Affordable house starts with the design phase itself, an integrated design approach by the Client is very much essential during the early phase of the project, in which the client, architect, structural engineer and the pre-caster needs to sit together to design the houses in a modular concept. This kind of modular design of the houses helps the client to reduce the cost of the project to greater extent. The optimum sizes of the rooms and standardization of the precast elements will be decided during this phase. The perfect modular design will have more sharing of structural members and walls between each tenement with consideration of good ventilation, MEP services and all architectural requirements. A good modular design concept will definitely save 10 to 15% of the project cost. The productivity will be much higher in modular design, thus the tenements can be delivered on time. There are some indirect

savings when the construction time is reduced, as we know that TIME = MONEY.

In general, there are two systems used by the pre-caster for the residential building sectors, one is framed structure and the other is wall and slab system. The contractor is free to choose one of these systems to be adopted for construction works and there are advantages and disadvantages in both the systems. In the precast framed structure, the structure is as good as conventional method of construction and the contractor is free to use light weight block works, which reduces the load on the structure and there will be some considerable savings in foundation works as well and here again the contractor has to engage huge labor strength to complete the task. In the wall and slab system, the masonry works is almost eliminated and the wall thickness is much lesser than the convention system which provides larger carpet area, but there will be some increase in the cost as the RCC wall replaces the light weight blocks. The contractor has to work out the cost factors, advantages and disadvantages of these two systems and to choose his preference.

When the design is made modular, the designer can opt for pre-stressed slabs (either Hollow core / Solid), where he can go for longer span slabs covering 2 or 3 modules, thus minimizing the number of columns and beams. The steel quantity also is reduced at least by 30% in the slabs, as in hollow core slabs only pre-stressing cables are being used and in solid slabs, pre-stressing cables along with nominal MS weld meshes can be used. It is observed based on various studies that Precast Technology can brings the cost down. In general construction cost depends upon the 3M – Men, Materials and Machineries which plays a big role which is decided by the 4th M that is the top Management.

Men: In Precast Technology the man power used is almost 1/10th comparative with the conventional method of construction, as most of the works are done by machineries. When one can reduce the manpower, there is direct cost savings in labor component and there is some other cost savings such as lesser requirement of labor hutments, labor license fee, insurances, water, power, sanitary facilities, ESI, EPF charges etc. More than the above cost saving the contractors will be relieved to have lesser supervisory staffs and avoid managing the huge labor's strength which itself a big challenge for them.Government can identify affordable house construction at rural areas for their current 100-day work scheme under NAREGA for rural people, which will create job generation for them and at the same time their services shall be used for good cause.

Materials: On the material saving, there are few items which most of the contractors ignore but it really has huge impact on the project cost as listed below;

In precast technology, the shutters used are steel moulds, which can be used for more than 500 repetitions, whereas the conventional method of shutter made of plywood which are used to 6 to 8 repetitions and later it is being scrapped for zero value or used as fire woods by the workers. Whereas in steel moulds even after 500 repetitions, it can be scraped for 50% of the material cost. In precast technology, the steel consumption shall be optimized as you have the bar bending schedule for the entire project at the beginning stage of the project itself. In case the pre-caster chooses to go for two tier or three tier columns the column lap length happens only on the second or third floors.

In general the concrete grade used for precast elements are M30 to M40, which is higher than the conventional method of construction. There may be an increase in the cost of the concrete, and again when the grade of concrete is increased the lap / development lengths of the structural members shall be reduced. Indirectly the end users get higher durable products which will also keep the contractor's mind

in peace.On the precast members such as walls, columns, beams, slabs, and staircase, the plastering shall be completely avoided as the surface itself good enough to receive patty and paint.

Machineries: On the machinery part, precast technology requires suitable cranes for erections works, upon selecting the correct cranes for the project the contractor may be spending little more comparatively with the conventional method of constructions, As these cranes rental charges are expensive, it is advisable to make capital investment in order to reduce their impact on the rates or by deploying additional crane operator and operate the machine for 24 hours so that machinery rental charges is halved and there will good increase in the productivity. When there is saving in material this little increase in cost will not have an impact in overall cost of the project.

Onsite precast yard can be established for construction volume of over 5 lakhs square feet. Onsite precast yard can't be compared with the state of art precast plants as the efficiency will definitely differ. There are number of advantages of having onsite precast yard.

GOVT. HOUSING SCHEMES

Various housing Schemes announced by Govt. of India is there in India. One such is Rajiv Awas Yojana on Ministry of Housing Urban Poverty Alleviation, Govt. of India (announced on Aug 2009) for slum free India. The aim was providing a slum free India within five years. However the effort involved on ground was not sufficient by both Central and State Govt. Thereby we are nowhere near to achieve the target made so far. Now the new housing policy declared by present Govt. is being giving special emphasis on low cost housing for poor people.

Govt. of India has launched this year "Housing for all by 2022" aimed for Urban areas with the following components/option to States/ Union Territories and cities:

- Slum rehabilitation of slum dwellers with participation of private developers using land as a resource;
- Promotion of affordable housing for weaker section through credit linked subsidy;
- Affordable housing in partnership with public private sectors and
- Subsidy for beneficiary-led individual house construction or enhancement.

The Mission is also supposed to compile best practices in terms of affordable housing policies of the States/UTs designs and technologies adopted by States and Cities with an objective to spread best practices across States and Cities and foster cross learning. In fact low cost housing does not mean the development of housing by merely spending less amount of initial money and reduced specifications. In essence, low cost housing is housing that result from much in-depth considerations and considering life cycle cost in mind. In that direction thereby there is a lot of scope for research and development work for finding out best locally available materials keeping environment effect in mind for low cost housing construction.

CONCLUSION

One of the dire needs in India is that of housing, especially for the lower end of the spectrum. The objective of achieving affordable low cost housing for masses needs to be realized in a holistic manner, through multi-pronged strategies. Mass housing affordable housing targets can be achieved by replacing the conventional methods of planning and executing building operation based on special and individual needs and accepting common denominator based on surveys, population needs and rational use of materials and resources, keeping green building concept in mind for sustainable development. Adaptation of new technology/

methodology as discussed in the paper and use of new materials and re-use of materials in a cost effective manner is the key, as construction in our country is still primitive as compared to developed world. Lot of R and D project/work is required to meet the demand of mass population in an affordable manner.As brought out in the paper, it has become imperative to produce innovative building technology for various elements of construction and take recourse to alternative technology, considering the short supply, increasing cost and energy and considering environment consideration for traditional and conventional materials.

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IMPERATIVE OF AFFORDABLE HOUSING TECHNOLOGIES IN HOUSING FOR ALL

Dr. Indrasen Singh*

Abstract

Keeping in view the gigantic task of providing affordable housing to masses, adoption of a cost effective technology assumes great significance. The present strain on Indian economy and the overgrowing demands for housing calls for adoption of appropriate building technology which could lead to economy and speed in construction. As a result of experimentation with innovative construction techniques and modern construction management it is now possible to achieve an overall saving to an extent of 10% in the total cost of housing construction.

There is growing realization today that speed of construction needs to be given greater importance especially for large housing projects. This is not only essential for the faster turnover of equipment and investment, leading to possible reduction in the housing cost, but also for achieving the national objective of creating a large stock housing in a shortest possible time. Fortunately some of the advanced technologies catering to faster speed of construction are already available in the country. By and large, conventional building technologies like burnt bricks, steel and cement are high in cost and use large amount of non-renewable natural resources like energy, minerals, top-soil, forest cover etc. These increase dependence on external materials and manpower, harm the local economy and are generally polluting in nature. So it is the need of hour to explore better, faster and yet affordable low cost technologies.

INTRODUCTION

There should be a logical approach for providing appropriate technology based on the availability of options, considering its technical and economical analysis. There should be optimal space in the design considering efficiency of space and minimum circulation space. Economy should be considered in design of individual buildings, layouts, clusters etc. While preparing the specifications it should be kept in mind that, cost effective construction systems are adopted. Energy efficiency is also of considerable importance due to energy crisis in developing countries.

TECHNOLOGIES USEFUL FOR AFFORDABLE HOUSING

Rapid Wall Technology

The threat of climate change caused by the increasing concentration of green house gases in the atmosphere is pushing the whole world into a catastrophic crisis situation with universal concern. The need of the 21st century is for energy efficient and eco-friendly products. The building industry accounts for 40% of $C0_2$ emissions. Building construction causes $C0_2$ emissions as a result of embodied energy consumed in the production of energy intensive building materials and also the recurring energy consumption for cooling and heating of indoor environment.

Rapid wall is also called gypcrete panel which is an energy efficient building material with huge potential for use as load bearing and non-load bearing wall panels. Rapid wall is a large load bearing panel with modular cavities suitable for both external and internal walls. It can also be used as intermediary floor slab/roof slab in combination with RCC as a composite material. Since the advent of innovative Rapid wall panel in 1990 in Australia, it has been used for buildings ranging from single storey to medium - high rise buildings. Light weighted Rapid wall has high compressive strength,

*Senior Professor and Dean, National Institute of Construction Management and Research, Goa

shearing strength, flexural strength and ductility. It has very high level of resistance to fire, heat, water, termites, rot and corrosion. Concrete infill with vertical reinforcement rods enhances its vertical and lateral load capabilities. Rapid wall buildings are resistant to earthquakes, cyclones and fire.

Physical and Material Properties

Rapid wall panel is world's largest load bearing lightweight panels. Standard panels are manufactured with size 12 m lengths, 3m height and 124 mm thickness. Each panel has 48 modular cavities of 230 mm x 94 mm x 3mm dimension. The weight of one panel is 1440 kg or 40 kg/m^2. The density is 1.14g/cm^3, being only 10-12% of the weight of comparable concrete /brick masonry. The physical and material properties of panels are as follows:

- Weight =40 Kg/ m^2
- Axial load capacity= 160 KN/m. {16 tons/ m}
- Compressive strength= 73.2 Kg/cm^2
- Unit Shear strength = 50.90 KN/m
- Flexural strength= 21.25 kg/cm^2
- Tensile Strength= 35 KN/ m
- Ductility= 4
- Fire resistance 4-hr rating withstood = 700-10000 C
- Thermal Resistance R =0.36 K/W
- "U "Value= 2.85W/M2K
- Thermal conductivity= 0.617
- Elastic Modulus= 3000-6000Mpa
- Sound transmission {STC} = 40
- Water absorption= <5%

The vertical and lateral load capability of Rapid wall Panel can be increased many fold after placing reinforcement rods vertically. As per structural requirement, cavities of wall panel can be filled in various combinations (Fig.1.).

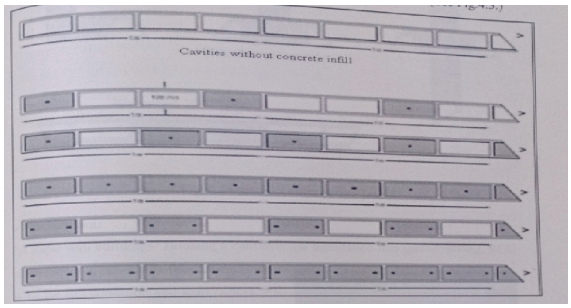

Fig. 1 : RCC infill to increase load capability

Joints

Wall to wall 'L', 'T'',' +' angle joints and horizontal wall joints are made by cutting of inner or outer flanges or web appropriately and infill of concrete with vertical reinforcement with stirrups for anchorage.

Foundation

For Rapid wall buildings/housing, a conventional foundation like spread fooling, column footing, and rafter pile foundation is used as per the soil condition and load factors. RCC plinth beam is provided at basement plinth level. For erection of panel as wall, 12 mm diameter vertical reinforcement of 0.75m long of which 0.45m protrudes up and remaining portion with 0.15m is placed into the RCC plinth beams before casting. Starts up rods are at 1m centre to centre.

Rapid Construction

Rapid wall enables fast track method of construction. Conventional building involves various cumbersome and time consuming process like(i) masonry wall construction (ii) cement plastering requires curing (iii) casting of RCC slabs require centering and scaffolding and curing (iv) removal of centering and scaffolding and(v) plastering of ceilings and so on. It also contributes to pollution and environmental degradation due to debris left on the site.

In contrast, Rapid wall construction is much faster and easier. There is no debris left at site. Construction time is minimized to 15-20%. Instead of brick by brick construction, Rapid wall enables wall by wail construction. Rapid wall also does not require cement plastering as both

surfaces are smooth and even ready for application of special primer and finishing coat of paint.

Rapid Construction Method

As per the building plan, each wall panel will be cut at the factory with precision using an automated cutting saw. Door/window/ventilator, openings for AC unit etc. are also be cut and panels for every floor is marked relating to building drawing. Panels are vertically loaded at the factory on still ages for transport to the construction sites on trucks. Each still age holds 5 or 8 pre-cut panels. The still ages are placed at the construction site close to the foundation for erection using vehicle mounted crane or other type of crane with required boom length for construction of low, medium and high rise buildings. Special lifting jaws suitable to lift the pane are used by inserting into the cavities and pierced into webs, so that lifting/handling of panels is safe. Panels are erected over the RCC plinth beam and concrete is filled from top. All panels are erected as per the building plan by following the notation. Each panel is erected level and plumb and is supported by lateral props to keep the panel in level, plumb and secure in position. Once wall panels get erected door and window frames are fixed in position using conventional clamps with concrete infill of cavities on either side. Embedded RCC lintels are provided wherever required by cutting open external flange. Reinforcement for lintels and RCC sunshades can be provided with required shuttering and support.

Concrete Infill

After inserting vertical reinforcement rods as per the structural design and clamp for wall comers are in place to keep the wall panels in perfect position, concrete is poured from top into the cavities using a small hose to go down at least 1.5 to 2 m into the cavities for directly pumping the concrete from ready mix concrete truck. For small building construction, concrete can be poured manually using a funnel. Filling the panels with concrete is to be done in three layers of 1m height with an interval of 1 hr. between each layer. There is no need to use vibrator because gravitational pressure acts to self-compact the concrete inside the watertight cavities.

Embedded RCC Tie Beam All Around at Each Level Floor/Roof Slab

An embedded RCC tie beam to floor slab is to be provided at each floor slab level as an essential requirement of national building code against earthquakes. For this, web portion to require beam depth at top is to be cut and removed for placing horizontal reinforcement with stirrups and concreted.

Rapid Wall for Floor/ Roof Slab in Combination with RCC :

Rapid wall for floor/roof slab are cut to required size and marked with notation. First the wall joints and other cavities and horizontal RCC tie beams are in-filled with concrete; then wooden plank of 0.3 to 0.45 m wide is provided to room span between the walls with support wherever embedded micro beams are there; finally roof panels are lifted by crane using strong sling tied at mid-diagonal point, so that panel floats perfectly horizontal. Each roof panel is placed over the wall in such a way that there is at least a gap of 40 mm. This is to enable vertical rods to be placed continuously from floor to floor and provide monolithic RCC frame within Rapid wall. Wherever embedded micro beams are there, top flanges of roof panel are cut leaving at least 25mm projection.

Reinforcement tor micro-beams is placed and weld mesh as reinforcement is placed. Concrete is poured for micro-beams and RCC slab. This result in the embedded RCC micro beams and 50 mm thickness screed concrete becomes a series of “T” beams.

Erection of Wall Panel and Floor Slab for Upper Floor :

The following day, erection of wall panels for the upper flow can be arranged. Vertical reinforcement of floor below is provided with extra length so as to protrude 0.45 m to serve as start-up rods and lap length for upper floor. Once the wall panels are erected on the upper floor, vertical reinforcement rods are provided, door/window frames fixed and RCC lintel cast. Then concrete is filled where required and joints are filled. Then RCC tie beams all around are concreted. Roof panel for

upper floor is repeated same as ground floor. For every upper floor the same method is repeated.

Finishing Work :

Once concreting of ground floor roof slab is completed, on the 4th day, wooden planks with support props in ground floor can be removed. Finishing of internal wall corners and ceiling corners etc. can be done using wall putty or special plaster by experienced POP plasterers. Simultaneously, electrical work, water supply and sanitary work, floor tiling, mosaic or marble works, staircase work etc. can also be carried out. Every upper floor can be finished in the same way.

Monolithic RCC Framed Structure Inside Glass Fiber Reinforced Gypsum Panel :

In Rapid wall building an embedded monolithic, thin RCC framed structure is formed by(i) bottom RCC plinth beams,(ii) vertical columns of in filled cavities,(iii) vertical wall corner joints(iv) inter-connected horizontal RCC tie beams, integrated with(v) embedded RCC micro-beams and RCC screed in all floors. In effect this RCC frame is moulded inside the GFRG (Glass Fiber reinforced Gypsum) Panel.

The strength of building to take care of axial load and lateral/ flexural/ shear loads from wind or cyclone or earthquakes is due to the combination of inside RCC framed Rapid wall panel. Since the reinforced steel also encased within the GFRG panel, it is protected from corrosion.

Rapid Wall Building/Housing is Cooler :

Conventional building materials like concrete have high thermal conductivity and low thermal resistance. Conventional concrete roof and walls radiate heat inside the building. Heavy electrical energy is to be used to maintain indoor comfort level. There will be high electrical energy for heating the indoor during winter. In contrast Rapid wall panel have low thermal conductivity and high thermal resistance. A comparative research study by Mohd. Peter Davis et al in 2000 in University Putra Malaysia, Selangor, found that in summer indoor temperature of Glass Fiber Reinforced Gypsum panel building is cooler by 5 to 6 degrees Celsius as compared to concrete building, The high thermal resistance of Rapid wall will keep interiors cooler in summer and warmer in winter, saving substantial recurring energy use.

Rapid Wall is for Affordable Quality Housing :

Access to adequate shelter at affordable cost by low income section and common people is very important for India for inclusive development. The booming of real estate and construction industry has indeed shot up the cost of construction due to the ever increasing cost of cement, steel, bricks, river sand, concrete materials and labor cost. In this situation, safe and good quality housing will become unaffordable to all the sections.

Commonly used wall in India is brick masonry. Cost of brick wall with two sides cement plastering has increased by almost 4 times during the last 5 years as seen in Fig. 2. Brick wall construction cost was Rs. 460/m2 in 2003. This increased to Rs 1700 /m2 in 2007. In view of likely increase in cost of energy, bricks, cement, river sand, water, labor and hire charges for scaffolding etc. the cost of masonry made of bricks or concrete blocks will continue to rise in future.

This will make Rapid wall panel much cheaper and affordable to the building industry while it will also help to protect the environment, as one m2 panel will save carbon emission reduction substantially. Rapid wall panel has excellent acoustic properties. Testing of panel by IIT Madras found that the panel belongs to a class of STC 40 with respect to air-borne sound insulation. Infill of cavities with locally available cheaper materials like quarry dust mixed with cement (1:20) and water or sand and cement (1:20) up to lintel/ window height can make the wall solid and address security-related concerns. In Rapid wall construction, especially in repetitive type mass housing, time for construction will be reduced by 75-80% thereby reducing overall overhead establishment costs with reduced lock up investment period and less labor component.

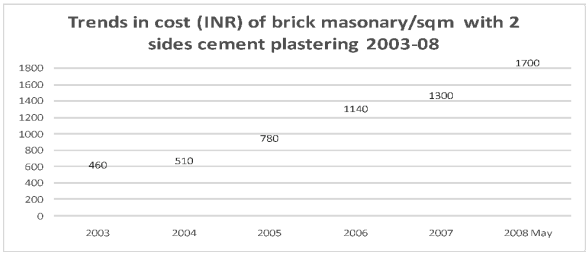

Fig. 2 : Cost of Construction of 1m² (10.76 sft or 8.12 cft) 9" thick quality brick wall in cement mortar 1:6 and both sides (2 m² or 21.52 sft) plastered in cement mortar 1:6.

Table 1: Comparison of Rapid Wall Vs Conventional Building

Materials/ items	Rapid wall building	Conventional building	Savings in %
Cement	16 tons	32.55 tons	50.8
Steel River Sand	1800 kg 20cum	2779 kg 83.37 cum	35.2 76
Granite Metal	38 cum	52.46 cum	27.56
Bricks	-	57200	
GFRG Panel	500 m2	-	-
Water	50000 liter	200000 liter	75
Built Area	143 m2	154.45 m2	8
Labour	389 man days	1200 man days	67.59
Construction Time	21 days	120 days	82
Total Weight of superstructure	170 tons	490 tons	65
Construction Cost	Rs. 13.25 lakhs	Rs. 27 lakhs	27.47%
Embodied energy in kWh	82921	215400	61.5

[www.frbl.co.in/rapidwall_for_housing.pdf]

Comparative study of Rapid wall building and conventional building (2 storey 150 sqm) shows significant savings in Rapid wall buildings. Embodied energy of Rapid wall building is only 82921 kWh, while conventional same size building would have 215400 kWh, thereby saving 61.5% embodied energy (Table 1).

Uses of Rapid Wall Construction

The most valuable use of Rapid wall is its use as load bearing wall in multi storey construction in combination with RCC. Rapid wall can also be used as non-load bearing and partition wall in RCC framed structures. IIT Madras has developed method of fixing panel in between RCC columns; beams and floor slab with impinge system. By this panel can be fixed to floor slab and panel at bottom using screws, which is embedded within flooring and skirting. At top, clamps will be fixed to panel and ceiling slab or beam. On sides also, this can be clamped at bottom to RCC column, floor slab and panel. Plastering of walls can also be saved thereby saving time and cost. If this is taken into account at design stage itself, dead load reduction of more than 50% can be made. This will result in savings in foundation. RCC columns and beams, in terms of steel and concrete. This will make substantial saving in cost of construction.

CONCLUSION

Rapid wall Panel provides a new method of building construction in fast track, fully utilizing the benefits of prefabricated, light weight large panels with modular cavities and time tested conventional cast-in-situ constructional use of concrete and steel reinforcement. Rapid wall panels result in reduction of embodied energy and require less energy for thermo-regulation of interiors.

Rapid wall buildings thereby reduce burdening of the environment and help to reduce global warming. This will also contribute to achieve the goal of much needed social inclusive development due to its various benefits and advantages with affordability for low income segment also. Fast delivery of mass dwelling/ housing is very critical for reducing huge urban housing shortage in India in a time bound manner.

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AN OVERVIEW OF PREFABRICATED BUILDING TECHNOLOGIES FOR MASS HOUSING

V. SRINIVASAN* AND S. K. NEGI**

Abstract

Shelter is one of the basic human need. It creates a strong ground for healthy and hygienic life. The housing problem continues to be acute because of the rapid growth of population, cost of building materials and labour. The Indian economy is rapidly expanding and there is also a growing demand for housing. Prefabricated buildings are appropriate and economical for taking up rapid mass housing programmes. Several such building techniques as developed at CSIR-R & D Institutes have been explained briefly in this paper.

Salient features of semi-mechanized mass production of concrete/stone blocks for masonry are described. RC L-Panels were mainly used for sloped roofs in addition to other minor applications in a building which were used in large scales in India. The precast RC trapezopanels have versatile applications for sloped roof, flat slab and folded plate roof in addition to minor uses in buildings. This paper contains the details of innovative Brick Shell-Pan roofing and composite structures for supporting the roofing/flooring systems.

INTRODUCTION

Housing is one of the basic human necessities next to food and clothing as well as an essential component for socio-economic development. A certain minimum standard of housing is essential for healthy and civilized existence. The social quality of life is reflected to a large extent in the state of its housing. It creates a strong ground for healthy and hygienic life. However, the housing problem continues to be acute because of the rapid growth of population, cost of building materials and labour. In India, the urban housing shortage was estimated around 18.78 million dwelling units and total rural housing shortage was around 43.9 million dwelling units, and 90% of this shortage pertains to BPL families. Shortage of houses is mainly due to the increasing population, shifting of masses from rural areas to urban areas and geographical status of the country which results in destruction of houses due to natural calamities. The construction activities intended to provide shelter, operating as a part of the general stream of economic activities, generation of large employment opportunities and greater income potential, mainly in rural area. A change in socio-economic patterns from traditional agriculture to manufacturing industry has changed the planning patterns and construction systems in urban as well as rural areas.

A number of factors inhibit development of housing on large scale in consonance with the requirement. Shortage of developed land in general, slow pace of land development and land assembly are among the important factors that decisively inhibit faster delivery. In addition, with the building construction costs increasing by around 12-15 percent each year. Reasonable housing is becoming unaffordable even to middle income group households. Further lack of access to affordable finance for the lower income category population is another factor that inhibits housing deliver for the disadvantaged segments of the society. Especially in rural areas, denial of credit to the poor due to problems associated with legality, security of tenure, lack of regular and periodic income and proper assessment of repayment capacity forms a major hindrance to housing delivery system. This is mainly due to increase in cost of basic building materials like burnt clay brick, cement, steel, timber etc. As a result, the cost of construction using conventional building materials and construction forms.

The prefabricated buildings components are gaining importance due to quality, speed of construction and economy. There is increasing need

*Scientist, Advanced Materials Laboratory, SERC **Senior Principal Scientist, CBRI, Roorkee - 247 667

to provide a rational set of priorities and indicators for the construction, design and manufacturing industries (Fig.1). These three industries are well recognised, and in many respects, are interrelated and integrated. The overlapping central core "Prefab" identifies the potential for exploiting synergies in offsite / on site, particularly the changing needs of the core offsite business as a whole – taking into consideration market maturity and the rising new innovation opportunities evidenced in this area.

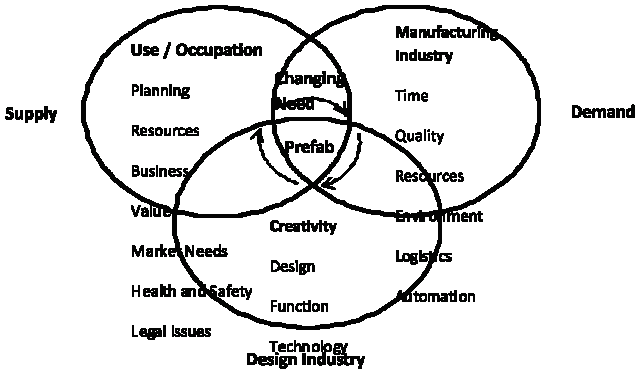

Fig. 1 Design, Construction and Manufacturing : Prefab Interrelationships

(Source: CIB 372)

Improved construction technology and methodologies can help execute housing projects more efficiently and in lesser time. Construction techniques such as prefabricated and modular construction, and innovative construction materials can further help execute projects in lesser time and with reduced resources. Several innovative building techniques with small precast units were developed in the R & D Institute with quite faster methods of production, economic constructions and lighter components and durability. Due to scope of repeated use and other advantages, these techniques are quite appropriate for mass housing programmes specially in rural areas. A number of building materials and components for walling and roofing have been developed. The production units for building components such as blocks, ferrocement components, precast roofing channels, RCC planks etc can be established with low investment and with short duration training to unskilled and semi skilled workforce. The salient features and brief details of these systems are presented in this paper.

MODULAR COORDINATION

A module can be defined as basic dimension which could for example form the basis of a planning grid in terms of multiples and submultiples of the standard module. The basis of Modular Coordination (MC) is essentially L by based on;

- The basis module; M = 100 mm
- Standardised multi-modules
- A reference system to define coordinating spaces and zones for building elements and for the components which form them
- Rules for locating building element with in the reference system
- Rules for sizing building component in order to determine their work sizes

Modular coordination would also enable buildings to be so dimensioned that they can be erected with standard components without undue restriction on freedom of design. It would also permit a flexible type of standardization, which encourages the use of a limited number of standardized building components for the construction of different types of building, thus optimizing the number of standard sizes of building components. Another important benefit is the ability of modular coordination to encourage the interchangeability of components, whatever material, form or method of manufacture. In addition to simplifying site operations by rationalizing setting out, positioning and assembly of building components, it would also ensure dimensional coordination between installation (equipment storage units, other fitted furniture, etc) as well as with the rest of the building.

DIMENSIONAL COORDINATION

The concepts are as follows;

- Size components so as to avoid the wasteful process of cutting and fitting on site
- Obtain maximum economy in the production of components
- Reduce the need for the manufacture of special sizes
- Increase the effective choice of components by the promotion of interchangeability.

Problems associated with dimensional coordination;

- Shortening of elements due to differential creep and shrinkage

- Differential elastic shortening due to the differences in modulus of elasticity and stress / strain relation of different elements
- Changes in the deformations due to the difference in the ages of different pre-cast elements
- Warping of wall panels due to the differences in interior and exterior temperatures and relative humidities.
- Differences in the deformations due to problems in long term durability problems in the concrete such as cracking, corrosion, shrinkage, and swelling etc.

SUPER STRUCTURE WALL

The construction of walls, burnt clay bricks, rammed earth, soil cement blocks, hollow blocks, dense concrete blocks, small, medium panels etc. of different sizes are used. However, bricks continue to be backbone of the building industry. In normal construction, the number of the bricks as blocks that are broken into different sizes to fit into position at site is very large As a result of this, there is wastage of material and the quality of construction also suffers. Several prefabricated technologies have been developed and executed for walls.

Solid Concrete Blocks

Innovative techniques of solid blocks with both lean concrete and stones were developed in the Institute. The Gang-Mould as shown in (Fig. 2) was developed with semi-mechanized faster production of the blocks. This technique is quite appropriate in hill areas where stones and aggregates for the blocks are available in cheaper rates. Mass production of the stone/concrete blocks can be possible in parallel stacks.

Fig. 2 Mass Production and Gang Mould

CLAY FLY-ASH BRICKS

Clay Fly-Ash bricks are made by manual or extrusion process involving mixing of Fly-Ash (60 %) with clay of moderate plasticity. The green bricks are dried under ambient atmospheric conditions or in shed to equilibrium moisture level of below 3 percent. Dried bricks are fired in traditional brick kilns at $1000^{o} \pm 30^{o}$ C. These bricks reduce precious top soil as well as consumption of coal required in making conventional clay bricks.

FLY-ASH SAND LIME BRICKS

By mixing of lime and Fly-Ash in the presence of moisture, Fly-Ash sand lime bricks are made. Fly Ash reacts with lime at ordinary temperature and forms a compound possessing cementitious properties. After reactions between lime and Fly Ash, calcium silicate hydrates are produced which are responsible for the high strength of the compound. Bricks made by mixing lime and Fly Ash are therefore, chemically bonded bricks. The bricks are manufactured with the help of hydraulic press and are dried in the autoclave (Fig.3). These bricks are suitable for use in masonry just like burnt clay bricks and have various advantages over the clay bricks. It possesses adequate crushing strength, uniform shape, smooth finish and does not require plastering. These bricks are lighter in weight than ordinary clay bricks and have cement colour in appearance.

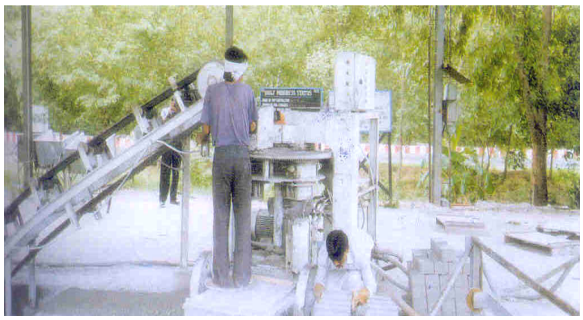

Fig. 3 Hydraulic Press Manufacturing Fly-Ash Bricks

SMALL WALL PANEL UNIT

A small wall panel system has been developed as a unit, it will act as a wall panel and will be used as a block in construction. It will also be easy to handle by two persons on site. As per normal construction, the units can be placed as wall with the help of small columns on the functions. Steel mould is fabricated using steel sheet with easily detachable nut and bolt connections. Small hollow panel units of dimension 15 x 45 x 30 cm (Fig. 4) have been conceived with 3.5 -6 cm concrete sections in the shape having two rectangular holes with larger size on one side, to ease in the production process. It will help to remove the mould to create hollow portions in the

panel unit. It is designed on one side as male and other side as female part to give proper connectivity. The concrete mix was placed in moulds and was properly compacted. The hollow blocks were taken out from the moulds and were placed on open space for a week. After one week, when the specimens had attained sufficient strength for handling. Similarly a half unit has been developed of size 15 x 22 x 30 cm having single rectangular hole and same size of male and female parts to be used in the construction of wall to avoid the vertical joint and give a proper bond. The weight of the main unit is 27 kg and that of half unit is 12 kg which can easily be handled manually by two and one labour respectively.

Fig. 4 : Small Wall Panel Unit

ROOF / FLOOR

Prefab Brick Panel System for Roofing

This process is for making prefabricated brick panel roofing system. It is ideally suited for providing durable and economical roofing / flooring in the low cost houses specially for economically weaker sections of society in rural/urban areas. This system consists of partially precast RCC joists (13cmx10cm), supporting the prefabricated brick panels of size 53cmx120cm, having 6mm dia. ms bars (2Nos.) in each panel and is covered with 35mm thick cement concrete. By this system the use of shuttering is eliminated. The length of panel may vary according to the room size (Fig. 5).

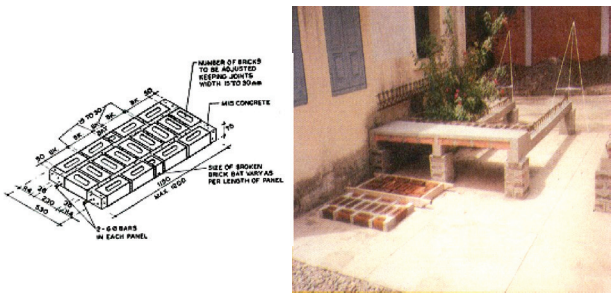

Fig. 5 Isometric View of Brick Panel and Prototype

The 6mm dia bars are on each panel both-ways are provided over the panels before laying cement concrete to serve as negative distribution and temperature reinforcement. The system offers saving of 25-30 percent against 115 mm thick RB roof slab. The gap between the two panels is about 20 mm and can be increased to 50 mm depending upon the need. A panel of 90 cm length requires 16 bricks and a panel of 120 cm require 19 bricks. The system has been adopted in various part of the country

PREFAB JACK-ARCH PANEL

This process is for roofing by making prefab jack-arch panels and RCC joists. RCC roof or traditional RBC roofs are costly due to high requirement of material and labour. Small size unreinforced jack arch panels (51x48 cm) are prefabricated with brick and cement mortar over a humped platform and later one over the other. The partially precast RCC joists are made on a leveled platform using reinforcement as per design (Fig. 6). The jack arch panels are supported on RCC joists and haunches filled with cement concrete (M-15) to level the top surface. By this system the use of shuttering is eliminated. The system offers 35% saving on overall cost of the roof as compared to conventional RCC. The ceiling provides a aesthetically pleasant look.

Fig. 6: Prototype of Jack Arch Panel

L-PAN ROOFING

The precast full span Reinforced Concrete L-panel is of section 'L' as shown in (Fig. 7). The RC units can be cast with simple timber / steel moulds and are easy for manual handling with simple lifting and hoisting gadgets. The L-panels

are supported on parallel gable walls and are used for sloped roof of a building. L-pan roofing is quite lighter in weight, economic in construction and sound in performance and durability. In addition to roof, the L-panels can be used for making loft, cooking platform, parapets, and many other minor elements of buildings and structures. Nominal width of units are 300 mm or 600 mm with overall depths of 130 mm to 200 mm. The lengths of the units are adjusted to suit the span. The flange thickness is 30 mm to 35 mm. The technique has been used widely in many mass housing programmes specially in rural areas. Ferrocement lighter components have also been made with L-panels.

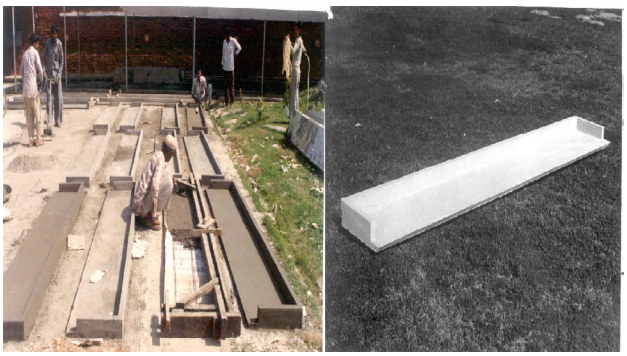

Fig. 7 Casting of L-Panels Roofing

TRAPEZOPAN ROOFING/FLOORING

The precast RC panels of trapezium section in orthogonal directions as shown in (Fig. 8) are used for making roof and floor of a building. The Trapezopanels can be cast one above the others in stacks as with many advantages. Simple moulds of timber or steel sections can be used. Due to stack casting one above the others, the heat of hydration and moisture are trapped resulting in easy and quick curing of concrete. The Trapezopanels have been used for making sloped / flat roof and flat floors with partially precast joists supporting as beams and folded plate roof without any joist. On-site prefabrication even at upper floors or without any pucca platform with efficient curing even at extreme climates are possible in this technique. In addition to above uses, the panels can have several applications for making loft, parapet, cooking platform, landing/ flight slab of stair-case, thin walls, bins, cot, bridge decks, toilet and inspection chambers and many other elements of buildings and structures.

Fig. 8 Prototype Building with Trapezopan Roofing

The Trapezopanels are sound and lighter in weight and can be commercially produced and supplied to distant places including villages. This technique is quite ideal for vast Indian continent and appropriate for all climatic zones from coastal to mountainous areas.

BRICK-SHELL-PAN ROOFING

Un-reinforced precast panels made of burnt clay bricks with cement mortar as shown in Fig. 9 were used to make shell roof. The panels are cast one above the other in stack method of production with several advantages. Many layers of brick-shells can be made in a day in a single stack and it needs no 'pacca' platform for production. The vaulted shell roof can be of two forms, one without any joist and another with partially precast joists. The panels can also be used for making corrugated walls, culvert and bridge decks in addition to the vaulted roofs in numerous forms for rural applications.

Fig. 9 Unreinforced Brick Shell Panel Roofing

FLAT-PANEL ROOF AND FLOOR

A RC flat panel as shown in (Fig. 10) was developed for flat roof and floor with structural improvement of earlier developed solid planks and with almost instant casting of the panels with the semi-mechanized mould. The total thickness of the slab is 6 cm. RC planks are made with thickness partly varying between 3 cm and 6 cm. There are haunches in the plank which are tapered. When the plank is put in between the joists, the space above 3 cm thickness is filled with in-situ concrete of grade M15. The planks are made in module width of 30

cm with maximum length of 150 cm and the weight of the panel is around 50 kg. The RC panels are also quite strong and light and the flat-pan roofs will be quite leak-proof after making in-situ haunch filling with concrete and reinforcement. The components can be commercially produced and used in rural areas for low cost buildings with both sloped roofs and flat roof / floors.

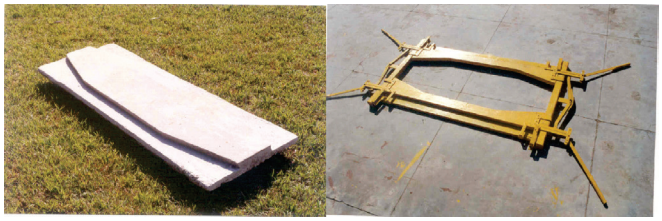

Fig.10 Precast RC Flat Panel and Mould

CONCLUSION

In present scenario, speed, quality and economy of construction are the issues of housing. Appropriate solution to provide affordable quality housing with socio-culturally acceptable and environment friendly characteristics continues to be a serious challenge for architects, planners, builders, engineers and government. Several innovative materials and construction techniques have been developed for a wide variety of applications in buildings, specially in low cost mass housing programmes in rural and semi-urban areas. These material and techniques are effective, affordable and easily adoptable. There adoption adds to improvement in the housing environment as well as improvement in the quality of life of the people. These technologies may be implemented with local labour and therefore improve the economic condition of the villagers. There is also a need to study the various aspects of housing like house design, settlement planning, construction techniques, local materials and skills, socio-economic and cultural patterns and infrastructure.

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TECHNICAL SESSION IV : ENERGY CONSERVATION

SUSTAINABLE REDEVELOPMENT OF SLUM AREA IN DELHI

KANIKA BANSAL*

Abstract

The rapid urbanization in India has made Indian cities as the prime economic centres resulting in high migration rates of semi-skilled and unskilled people from the undeveloped regions of the country. The influx of population has resulted in many physical, social and economic imbalances, along with unplanned growth and development of slums. The slum population constituting to about 31% of total urban population of the country resides in poorly built congested dwelling, in unhygienic environment, lacking inadequate physical and social infrastructure/open spaces and even safe drinking water.

The research proposal given in the paper is an attempt to understand the needs of the slum dwellers in Delhi (case study: Kalander Colony slum, Bhalswa) and redevelop the slum to livable conditions with social, economic and environmental upgradation. The case study of Kalender Colony slum at Bhalswa is explained.

INTRODUCTION

India being a developing country is undergoing the process of rapid urbanization with cities as the prime economic centres. The urban population in India has grown from 78 million to above 280 million in 2001, and is estimated to be double in next 25 years. (MHUPA, 2011), and have immense contribution to the GDP of the country.

The employment opportunities, both formal and informal, in the urban centres have attracted migrants from all over the country, particularly from the backward state areas due to regional economic imbalances. As per census 2011, about 31% of the total urban population of the country, i.e. more than seven crores consists of slum population which is predicted to cross ten crores by 2017 (MHUPA, 2011). The definition of slum as per United Nations and the Census of India is given in Table No. 1. The influx of population has resulted in an increased population of the city, pressure on civic amenities, crime, social imbalances, economic exploitation, unplanned growth, deterioration of the city beautification, culture etc. Hence, Slums have become the most critical problems of cities of today.

Though the society is concerned about potential health hazards and criminal dangers from the slum population, and demand their eviction from residential areas; they are dependent on slum population for their daily needs. Studies have revealed that settlers in these slums and JJ clusters indulge in various informal economic activities, thus, contributing to the city's economy. From domestic help and unskilled factory jobs to semi-skilled and manual work, they are now an essential requirement of the city's daily life. They normally work as cheap labour in industries and commercial centres and constitute majority of domestic helpers in the city, thereby performing sizable informal functions and are significant partners in city's life and existence.

Assistant Professor, Ramaiah Institute of Technology, Bengaluru

Table 1: Definitions of Slum

United Nations	"As a group of individuals living under the same roof that lack one or more (in some cities, two or more) of the following conditions: i. Security of tenure, ii. Structural quality iii. Durability of dwellings, iv. Access to safe water, v. Access to sanitation facilities and vi. Sufficient living area.
Census of India	"A compact area of at least 300 population or about 60-70 households of poorly built congested tenements, in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities". Or as specified/declared "slums" through State/UT or local government under any act

SLUMS IN DELHI

Delhi, the focus of the socio-economic and political life of India, a symbol of ancient values and aspirations and capital of the largest democracy, India, is assuming increasing eminence among the great cities of the world. The city with a population of about 22 million in 2011, is home to about 3% of the country's slum dwellers. The city provides better employment opportunities, economic stability and standard of living and attracts people from rural and undeveloped areas of states like Bihar, Jharkhand, West Bengal, Orissa, and other states. The migration rate is one of the highest in the country and it is estimated that migrated population constitute half the increase in the population. Because of the lack of adequate developed land at affordable prices, various types of unplanned settlements have come up in Delhi including (a) Notified Slums in Old Walled City area, (b) Unauthorised Colonies, (c) Urban Villages, (d) Jhuggie Jhopari Clusters or Squatter settlements.

The category of the urban poor majorly becomes the habitants of the inhabitants in JJ clusters / squatter settlements. As per the list of J.J. cluster by Delhi Urban Shelter Improvement Board, more than 600 JJ clusters, scattered all over the city, have been notified in Delhi in 2012 though some studies take the count beyond 1000. The city accounts to have more than 18% of its population living in such settlements. The growth of slums is given in Table 2.

Table 2 : Growth of Slums

Year	JJ Cluster	Area (Ha)	Population
1951	199	21.1	63745
1983	534	188.3	565000
1990	929	431.7	1295000
1997	1100	902.1	3000000
2001	1080	650.2	2148310

Source: (National Resorce Centre on Urban Poverty, SPA, Delhi)

CASE STUDY AREA: KALENDER COLONY, BHALSWA, DELHI

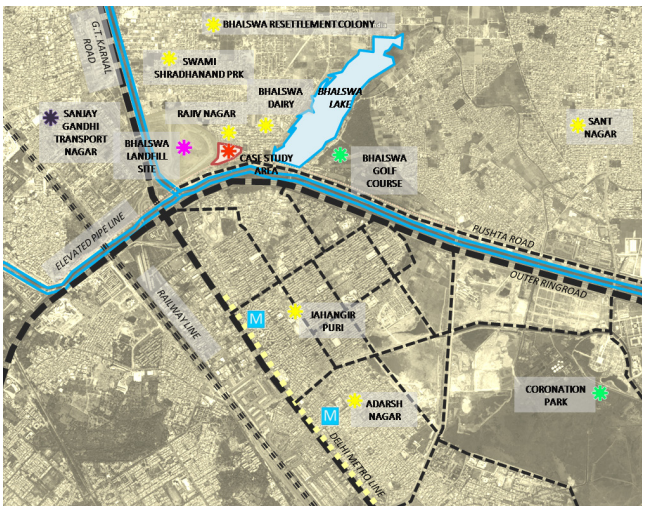

Fig. 1: Location and Surrounding of the Study Area

The case study area is one of the Jhuggie Jhopari clusters from the J.J list prepared by Delhi Urban Shelter Improvement Board (DUSIB), named Kalander Colony, Bhalswa. Bhalswa is situated in

North West Delhi, adjacent to Bhalswa Landfill Site and Bhalswa Lake, and in close proximity to River Yamuna. The area is identified as high concentration of JJ clusters in the City Development Plan for Delhi prepared under JNNURM Scheme of government of India. Kalander colony is divided into three parts with a total area of 5.6 hectares. The area consists of about 4900 jhuggies on the land owned by Delhi Development Authority. The area composition and profile is given in Table 3 and 4.

Table 3: Areas Composition

DUSIB Cluster Code	Location	Land owning Agency	Area of JJ Cluster in sqm
2338	Kalander Colony Part-C	DDA	22129 (2.2 Ha)
2333	Basant Dada Patil Cluster(Part-A) Kalander Colony	DDA	21697 (2.2 Ha)
2336	Bihari Samaj Vishwanath Puri (Part-B) Kalander Colony	DDA	12557 (1.2 Ha)

Source: Delhi Urban Shelter Improvement Board

PROBLEMS, ISSUES AND CHALLENGES

The area is having high density of nearly 1000 dwellings per hectare which is leading to congested unhealthy living conditions. The plot sizes are very small with less than 1.5 sq.m. of space available per person. The small dwelling unit of 9 sq.m. is quite packed with more than five people (Fig.2).

The conditions become even worse with the location of kitchen inside that heat up the air in the house due to no proper ventilation. Streets are narrow with only 0.75 meters wide which are not sufficient for two people to walk. The area lacks in green areas with degraded quality of the existing open areas.

Table 4: Area Profile of Kalander colony

Name of the slum	Kalander Colony
Number of Jhuggies As per Ground Check	4903
Estimated area in hectares	
As per Delhi Urban Shelter Improvement Board	5.6 ha
Estimated built up area	4.5 ha
Estimated area under circulation and open spaces	1.1 ha
Average Household Size Based on Primary Survey	5.5
Estimated population	26965
Estimated Area per person	2 sq.m.
Estimated Open area per person	0.4 sq.m.

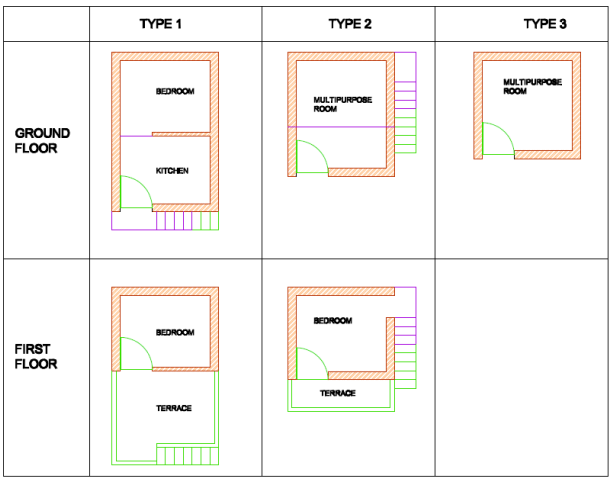

Fig. 2 : Unit Layout

The site is located next to one of the landfill site of the city which is leading to many problems. A major danger to human health from landfills such as Bhalswa is the use of groundwater that has been contaminated by leachate, along with visual pollution and trouble due to foul smell. Contaminants are leached from the solid waste as water percolates through the landfill

and mixes with ground water. According to study done by Hazard Centre and Bhalswa Lok Shakti Manch, hand-pump water had a total dissolved solids count that ranged between 2,300 and 5,800 parts per million, far exceeding the desirable level of 500 ppm. This exceeding limits in drinking water is the main reason of prevalence of water borne diseases including stomach infections, diarrhea, dysentery, cholera and jaundice among the residents. Regular contact with the polluted groundwater for use in domestic chores such as bathing, washing utensils and clothes has also lead to a large number of people suffering from skin irritation and itching and eye irritation. The groundwater is pale yellowish in colour and also foul smell some times.

Though the health problems are numerous due to contaminated ground water and exposure to the landfill site, the health centres are not adequate to serve the needs of the people. Also, the low income of the residents makes it impossible for them to get benefits from the private clinics. The area is a low lying area, in the water shed of Bhalswa Lake and in the flood plains of river Yamuna. The area is highly prone to urban flooding not only from heavy flow of storm water from the landfill site and the adjoining elevated outer ring road but also due to the saturation of soil as the ground water levels are shallow in the area.

Also there are inadequate numbers of schools available and poverty in the area, children are often forced to work places than to schools. There is very high student to teacher ratio in the available school. Girl child education is often neglected due to lack of accessibility to school. Most of the children are rag pickers, doing the job either full time or part time. There is no green space for children to play. Most of the open space is used as waste dump or for waste segregation. Lack of education, inclination to child labour and lack of play areas has affected the child mental and physical growth. The absence of sanitation facilities force women to go in open for defecate which has lead to high crime rates against women.

APPROACH ADOPTED FOR THE PROPOSED SCHEME

The proposed scheme has been made as a research exercise. Considering that the Bhalswa landfill site will be closed and landscaped very soon, relatively high land value of the site and most importantly the vulnerability of the site to get encroached by other group of urban poor, In-situ up-gradation and rehabilitation scheme for the case study Jhuggie Jhopari cluster of Kalender Colony would be more appropriate. Also the plot wise analysis of the case study area has identified a portion of the area which has a reasonably good condition and bears the unique character of the Urban Village, in harmony to the neighbouring area of Bhalswa dairy. The infrastructure provisions could easily be upgraded and strengthened to desirable a level which is feasible with the proposed formal planning approach.

The major problem of water supply could be tackled by ensuring the municipal supply to the people and by incorporating the rain water harvesting and recharge for daily uses and in dilution of pollutant in ground water. A thick green belt along the landfill site would further help in controlling the visual pollution. Electrical and sewerage connection could be provided by the Municipal Corporation at subsidized rates to the habitants.

The case study area could be improved by strengthening the infrastructure facilities and re-planning of the slums dwellings in modified layouts by redistributing the encroached land amongst the slum dwellers; along with developing the area in a comprehensive manner for the betterment of the society as a whole.

A site survey for plot wise condition of the indicators (Condition of the house; Number of floors) was done to decide type of scheme for the proposal. Based on the analysis of the indicators a susceptibility map has been prepared to identify the area to be conserved and strengthen in terms of infrastructure and area that need to be demolished and re-planned.

It is one of the strategies to maintain and strengthen the existing road network within the

area. Narrow roads are proposed for widening and broken network of roads are completed for the final road network of the proposed scheme.

CONCEPTUAL DESIGN PROPOSAL

Slums are robust communities and we are dependent on the slum population in our day to day lives. With the tough lifestyle they have to follow, slum dwellers tend to be sympathetic to each other and learn to live together as a community. A Community is formed when we work together, share resources in an equitable manner, share space and interact, and live in cohesiveness. The strong interaction among the slum dwellers had helped them to adjust in the poor conditions and acted as their strength.

The vision has been formed around the above statement, to support the robust slum community by creating more interacting spaces at different scales. The scheme (Fig.3) has been prepared for a cohesive society along with achieving the goals of sustainability, i.e. environmentally, socially and economically viable.

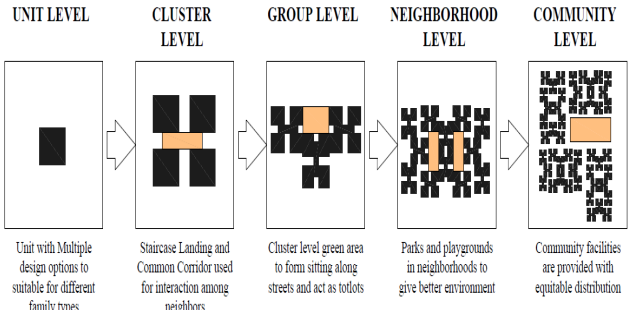

Fig. 3: Proposed Layout

The first two levels are provided the tertiary spaces within the unit and the cluster, which are the multipurpose spaces. Next level, cluster level, is provided with a courtyard which can be used as sitting space as well as totlot. The secondary space is provided by pedestrian oriented design to create interaction spaces for the neighbourhood in the market oriented society. At neighbourhood levels, parks and playgrounds are created for better environment. At community level, the primary functional spaces should provided along with community facilities like, schools, health centre, police station etc.

The area is divided into blocks for ease of analysis, which are based on the existing street pattern in order to maintain the street network as far as possible. Details of area, number of units and average area of units for each of the blocks is listed in order to decide the number of units in each of the proposed type of units.

It is observed that the area of DU varies from 3 sq.m. to 12 sq.m., which are divided into three types, desired number (must be equal to existing) of which has been obtained (Table 5):

Table 5 : Unit Typology

Unit Type	Existing Area in sq.m.	No. of Existing Units	Proposed Area in sq.m.
Type A	3-7sq.m.	2508	15 sq.m.
Type B	8-10 sq.m.	887	22.5 sq.m.
Type C	11 sq.m.& abv	211	30 sq.m.
	Total	**3606**	

Source: Author

A waste segregation unit in the adjoining land will organise the informal occupation rag picking in a systematic manner. The waste segregation unit can train the people with proper waste segregation mechanisms, which will help in several ways like: Condition of the open spaces will be improved, proper utilization of waste can be done as per its characteristics, and waste recycling can also be done.

The facilities should be provided keeping in mind an overall development of the community. It should be tried to provide the needs of all age groups from senior citizen area for the aged to child and women up-liftment centres. Along with the mandatory norms of the master plan, community up-liftment has been considered. The economic empowerment has targeted by providing vocational training centre with a special women welfare centre. Improved infrastructure and sanitation conditions, better living environment, well lighted and ventilated pucca houses will help the community in climate change adaptation.

ATTAINING SUSTAINABILITY

The comprehensive solution should be prepared with social, economic and environmental options incorporated to the extent possible:

"Share to Gain More"- Social Viability of the proposal

- Social design by providing Interaction spaces, community spaces, interacting streets
- Women and child up-liftment provisions like: Balika Vikas Kendra, Shishu Vikas Kendra, Women Welfare Center
- Social up-gradation by providing better living conditions and facilities like Schools, Community hall etc.

"Able the Enables" - Economic Viability of the proposal

- Housing first step of individual's economic growth
- A waste segregation unit to employ the rag-pickers
- Economic empowerment by providing vocation training centre
- Facility centre for commercial use
- Economic construction with low - cost materials.
- Possibility to accommodate economic up-gradation of residents

"In Response to Climate"- Environmental Viability of the proposal

- Passive solar design principles
- Unique design of each unit considering natural light and ventilation
- North south orientation
- Recycled, reuse and reduced water conservation approach
- Rain water harvesting
- Native plantation of peepal, arjuna, neem, etc. is proposed.
- Narrow shaded streets
- Innovative, recycled and eco-friendly materials

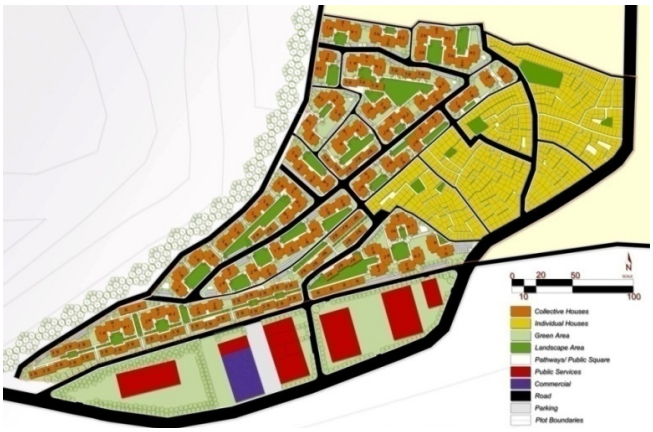

Fig. 4 : Proposal Scheme

Source Author

CONCLUSION

The area has been analysed and a sustainable redevelopment has been demonstrated by strengthening the infrastructure facilities and re-planning of the slum dwellings in modified layouts by redistributing the encroached land amongst the slum dwellers; along with developing the area in a comprehensive manner for the betterment of the society as a whole. Also in the same regard strategies for environmental, social and economic life of the residents are suggested and discussed.

MASS HOUSING: MYTH OR REALITY

Rajat Rashmi* and Raushan Kumar**

Abstract

Mass housing is the concept that was developed to house the population due to migration of large scale workers during the industrial revolution in the 19th century. When people in large numbers came to the city, they developed shelters in a haphazard manner to house themselves. There were almost no drainage and sewerage facilities leading to squalid conditions of living, main cause to disease and mass deaths. Large scale housing projects were developed all over the world by the mill owners to house the workers. Similarly, in Mumbai, the British had constructed the 207 BDD chawls around 1920, as low-cost housing for mill workers, dock workers, civic and other government employees. As urbanisation and industrialization grew, more and more people migrated to the cities. The continual migration of people to the cities has led to the problem of housing shortage, congested quarters and slum like conditions lacking basic amenities and facilities.

This paper deals with the concept of mass housing bringing out the facts where various governments have tried to reduce the gap in the housing demand and supply by various policies and schemes. It also analyses two case studies of slum rehabilitation namely Dharvi at Mumbai and Yerwada at Pune.

INTRODUCTION

According to the estimates by the Technical Group constituted by Ministry of Housing and Urban Poverty Alleviation, the urban housing shortage in the country is estimated to be 18.78 million where 96.52% is in the economically weaker section (EWS) and lower income group (LIG) category. The shortage in housing would be much less if we see the new housing stock added and persons requiring housing. There is a mismatch in it as the housing stock is added for people who can otherwise afford housing and the shelter-less and homeless people are still left in the same condition. Though the gap between the households and housing stock is narrowing, actual shortage is high as the current stock is either dilapidated or people are living in congested dwellings. The new stock that is added is for people who may shift from rented accommodation to their own house or shift in better housing or take it as an investment to rent it further to people. Since the private sector in the construction business concentrates on higher and middle segment of the society, the housing for poor and economically weaker section is primarily provided by government for welfare purposes. There is, therefore, a dearth of housing in the lower spectrum which basically needs to be addressed.

Due to high land prices in urban areas, the poor and the economically weaker sections of the society tend to occupy marginal lands where housing is put together with locally available material leading to poor housing stock and slum like conditions with no amenities. Usually a slum comes up on the outskirts of a city where land is either owned by the government or by some trust or on marginal lands along nallahs, railway tracks, city dumps and such like. They start with easily disposable materials such as tents; plastic sheets etc and as it grow in size, with discarded construction material available nearby. Initially few persons live and slowly the area may be taken up by gangs who charge people to live in such dwellings. When the slums cannot expand horizontally, they start expanding vertically to take in the demand of a growing family or sometimes as a source of rent from the new arrivals in the slum. Since the land is not owned by the people residing in the slum, no improvement is made to the area by

**Architect, CPWD, Mumbai & **Assistant Architect, CPWD, Mumbai*

putting money in it by the tenants. Government also does no development as it refuses to recognise the slums and will have to provide facilities. Acceptance of slums will also allow the slum to expand and more area to come under slums as the idea spreads that the government will recognise it sooner or later. Thus government policies have to be carefully laid out so as to address the shortage in affordable housing as well as to accommodate the marginalised people.

In the past three decades, government has adopted several policies assisting the delivery of affordable housing for the EWS, LIG and lower MIG. Some of the government interventions include

Valmiki Ambedkar Awas Yojna

The VAMBAY was launched in December 2001 to ameliorate the conditions of the urban slum dwellers living below the poverty line without adequate shelter.

The primary objective of the scheme was to facilitate the construction and up-gradation of dwelling units for slum dwellers and provide a healthy and enabling urban environment through community toilets under Nirmal Bharat Abhiyan, a component of the scheme. Some money was released by the government to increase toilet seats in the slums area and to improve the living conditions but the scheme was not very successful.

Jawaharlal Nehru National Urban Renewal Mission(JNNURM)

The JnNURM was launched in 2005 as the first flagship scheme of Ministry of housing and Urban Poverty Alleviation. JnNURM implemented by MoHUPA had two components e.g. Basic Services for Urban poor (BSUP) and Integrated Housing and Slum Development Programme (IHSDP) which aimed at integrated development of slums through projects for providing shelter, basic services and other related civic amenities with a view to providing utilities to the urban poor. 65 Mission Cities identified based on urban population (Census 2001), cultural and tourist importance was covered under BSUP and the remaining cities were covered under IHSDP (887).

'JnNURM were mandated to pursue 3 key pro-poor reforms, namely (a) earmarking of 25% of municipal budget for the urban poor for provision of basic services including affordable housing to the urban poor; (b) implementation of 7- Point Charter, namely provision of land tenure, affordable housing, water, sanitation, education, health and social security to the poor in a time-bound manner ensuring convergence with other programmes and (c) reservation of 25% of developed land in all housing projects, public or private, critical for slum improvement.'

Rajiv Awas Yojana

Rajiv Awas Yojana (RAY) envisaged a "Slum Free India" with inclusive and equitable cities in which every citizen has access to basic civic infrastructure and social amenities and decent shelter. Its mission was to encourage States/Union Territories (UTs) to tackle slums in a definitive manner, by focusing on:

- Bringing all existing slums, notified or non-notified (including recognized and identified) within the formal system and enabling them to avail the basic amenities that is available for the rest of the city/UA;
- Redressing the failures of the formal system that lie behind the creation of slums by planning for affordable housing stock for the urban poor and initiating crucial policy changes required for facilitating the same.

All these schemes and projects ran their course. Though the intentions were very good, the schemes did not fare well and the poor continued to live in marginalised lands and dwellings. The newest scheme under block is PMAY (Pradhan Mantri Awas Yojana). Under this scheme, government is committed to provide housing for all by 2022. This is one of the Sustainable Development Goal under United Nation mission to end poverty, protect the planet, and ensure prosperity for all.

Pradhan Mantri Awas Yojana

The Mission is being implemented during 2015-2022 and provides central assistance to Urban Local Bodies (ULBs) and other implementing agencies through States/UTs for:

- In-situ Rehabilitation of existing slum dwellers using land as a resource through private participation
- Credit Linked Subsidy

- Affordable Housing in Partnership
- Subsidy for beneficiary-led individual house construction/enhancement.

These policy initiatives focus on transition of public sector role as `facilitator', increased role of the private sector, decentralization, development of fiscal incentives and concessions, accelerated flow of housing finance and promotion of environment friendly, cost-effective and pro-poor technology. The population of India's homeless has fallen both as a proportion of the total population and in absolute terms between 2001 and 2011 as per the latest census data. The data also reveals that while there has been a sharp reduction of homeless people in rural India, their numbers in towns and cities have increased by almost 21%. This could be an indicator of policy moving in right direction and motivation to speed up the work.

MASS HOUSING- SHORTAGE AND ITS SOLUTION

According to the Technical Group, 'to design appropriate strategies to address housing shortage and monitor progress in different levels it is extremely important to determine the quantum of housing shortage. It is only when the nature and magnitude of the shortages are known in various income and tenure categories and across states that an attempt can be made to create the right policy environment and direct agencies linked with housing sector to prepare roadmaps for their action plan.'

In order to address the various issues, The MoHUPA had come up with the National Housing and Habitat Policy (NUHHP), 2007 which has outlined "Affordable Housing to All" as its mandate. The aim of this policy is to create an enabling environment for providing "affordable housing for all" with special emphasis on EWS and LIG and other vulnerable sections of society such as Scheduled castes/Scheduled Tribes, Backward Classes, Minorities and senior citizens, physically challenged persons in the State and to ensure that no individual is left shelter less. The Policy further aims to promote Public Private People Participation (PPPP) for addressing the shortage of adequate and affordable housing. The Ministry has decided to revise the NUHHP, 2007 to reflect the changes in the recent past and taking forward the agenda of Government of India on "Housing for All" by 2022. The revised NUHHP, 2017 will incorporate various policy sub-components to reflect the current direction of the Government of India.

DEFINITION OF AFFORDABLE HOUSING

According to the KPMG Report on 'Affordable Housing – A Key Growth Driver in the Real Estate Sector', affordable housing is defined in terms of three main parameters, namely income level, size of dwelling unit and affordability.

Table 1: Parameters for Affordable Housing

	Income Level	**Size of Dwelling Unit**	**Affordability**
EWS	INR 1.5 Lakhs per annum	Upto 300 sq ft	**EMI to monthly income:** 30% to 40% **House price to annual income ratio:** Less than 5:1 (Task Force headed by Deepak Parekh)
LIG	INR 1.5 – 3 Lakhs per annum	300 – 600 sq ft	
MIG	INR 3- 10 Lakhs per annum	600 – 1,200 sq ft	

Table 2: Definition of Affordable Housing – MHUPA (2008)

	Size	**Cost**	**EMI or Rent**
EWS	300 - 600 sq ft carpet area	not exceeding four times the household gross annual income	not exceeding 30% of gross monthly income of buyer
MIG	not exceeding 1,200 sq ft carpet	area not exceeding five times the household gross annual income	not exceeding 40% of gross monthly income of buyer

(Source: Task Force on Affordable Housing, MHUPA, 2008)

According to the Task Force on Affordable Housing set up by the MHUPA in 2008, affordable housing for various segments is defined by size of the dwelling and housing affordability derived by the household income of the population.

The JNNURM Mission Directorate of MHUPA has also defined affordable housing in its amended Guidelines for Affordable Housing in Partnership released in December 2011 (Table 3).

	Size	EMI or Rent
EWS	• minimum of 300 sq ft super built up area • minimum of 269 sq ft (25 sq m) carpet area	not exceeding 30–40% of gross monthly income of buyer
LIG	• minimum of 500 sq ft super built-up area • maximum of 517 sq ft (48 sqm) carpet area	
MIG	• 600–1,200 sq ft super built-up area • maximum of 861 sq ft (80 sqm) carpet area	

Source: Guidelines for Affordable Housing in Partnership (Amended), MHUPA, 2011

The state governments took various steps to develop mass housing as an initiative to 'housing for all'. The state of Maharashtra also formulated housing policy in 2015 where it laid emphasis on affordable housing – housing for poor. Regarding Mumbai, where affordable housing is an acute problem, the policy emphasises the role of redevelopment and cluster development (redevelopment of entire localities, instead of individual buildings), redevelopment of Dharavi slum, transit camps and old MHADA buildings, among others.

Thus, two approaches can then be taken to develop mass housing- in situ development of the slums or the developer is given higher FSI in lieu of the premium which can be utilized by the government to improve housing in the city itself.

CASE STUDY- DHARAVI SLUM, MUMBAI

Dharavi is the biggest slum in Asia located in Mumbai. (Fig.1) It houses not only the slum dwellers but also many industries thrive in that area. It is spread over an area of approximately 239 hectares housing approximately 6 lakhs people. Initially it was home for the koli fishing community and as it was at the edge of the island city, various artisans and migrants set up their trade and camp there. Further, people migrated to work in the mills and docks and resulted in haphazard conglomeration of various people and hutments resulting in its growth as the largest slum in Asia. As Mumbai expanded into the north, Dharavi was drawn into the middle. Whenever, space was taken for roads and road widening, people were relocated to transit camp. Still, the land occupied under the slum was large and continue to be so.

Fig. 1: Dharavi Slum

Under the prime minister grant project in 1987, Maharashtra Housing and Area Development Authority was declared as special planning Authority for Dharavi and under the project 27 buildings were built to provide shelter to number of families. In 1995, various schemes were approved for slum development which came up sporadically till 2004. In the year 2003-04, government of Maharashtra decided to redevelop Dharavi as an integrated planned township and it was decided to develop it by using land as a resource to cross subsidise the cost of development. There were no private players to take up the development and the scheme languished. The good intentions of government were not enough and the buildings and area deteriorated.

Fig. 2 : One of the Rehabilitation Scheme

In 2016, Honourable Chief Minister announced the development of Dharavi by public private

partnership for which the whole scheme was divided into 5 sectors of which four sectors are to be developed by private players and the 5th sector by MHaDA. But after a poor response from developers the four sectors has been further divided into 12 parts and is to be redeveloped by Slum Rehabilitation Authority (SRA). The development is yet to take place.

Observations

- Raised property values after selection of houses for reconstruction by the Prime Minister's Grant Programme (PMGP 1988) motivated the slum dwellers to accept reconstruction.
- Demand for redevelopment from slum dwellers was significantly larger than predictions compared to the option of tenure security provisions.
- Guided by convenience factor and real estate market values, Houses for the beneficiaries are not merely a "shelter" but a "real estate" property.

Case Study Yerwada Slum, Pune

The slums of Pune can be traced back to 1960's, setting up of industries acted as catalyst in its development. The narrow vision for development during the times when the industries were flourishing in Pune is the main reason of slum sprawl. The growth in the manufacturing industry created new employment opportunities. The city witnessed a large flow of crowd moving from surrounding villages and towns in search of better livelihood.

Yerwada ward was a slum-dominated locality. Some families had been living in Yerawada's slums for more than 50 years(Farrow, 2010). Congestion within and crowding outside the houses did not interfere in messy but lively atmosphere of slum life. Seven dense slums of Yerwada, i.e. BhatWasti, Chandrama Nagar, Mother Teresa Nagar, Netaji Nagar, Sheela Salve Nagar, WadarWasti, and Yashwant Nagar had been selected to rehabilitate some 1,200 families under Slum Upgrading Project(Express, 2009). These slums housed people of varied cultures and socio-economic backgrounds in mixed housing typology of pucca, kutcha and dilapidated kutcha nature.

Yerwada Slum Upgrade project was a part of Central government's scheme of BSUP under the JNNURM. The stakeholders involved in the project included primarily the beneficiaries and Central and State government, local municipal body, local political leadership and NGOs. In-situ concept had been adopted to carry out the project. The concept was to renovate only kutcha houses in harmonisation with existing pucca houses of the slum(Express, 2009). Community's need was identified by the alliance through house to house feedback on architectural models. The information collected from enumeration and socioeconomic surveys were visualized on maps, enabling beneficiaries and planners to identify scope and limitations in planning. Community workshops with architects' firm used three-dimensional models of the existing settlement to give residents perspective on their communities' space and relationships, street hierarchy, and density(SCHNDM (Smithsonian Cooper-Hewitt, 2012). Makeover of complete slum had been planned in integrated way; streets were widened and open amenity/community spaces were created by reducing the depth of individual houses thus improving the overall physical bio-environment with greater openness, penetration of natural light and air circulation.

A 25-square-meter (270-sq.-ft.), single-family structure included an in-house toilet and kitchen. Housing subsidy had been provided where 90 % cost was funded by the government and remaining 10% was borne by the beneficiary. Micro loans helped residents secure the ten percent required contribution. For those who could not pay the down payment of one third of required contribution, Mahila Milan, a CBO offered construction jobs. Residents cut costs through their involvement in unskilled works of construction.

Observations

Scheme was welcomed without any opposition. The slum received legal status and Community became a legal "colony" receiving a lease of ninety-nine-years. The aesthesis of new pucca buildings are complimenting the old pucca houses with harmonic transformation of the whole slum. A sense of safety and security is developed with pucca construction and proper sanitation facilities for new houses. Residents are happy with improvement in quality of life.

This project was selected by Smithsonian Hewitt, National Design Museum, New York to display its model at an exhibition titled Design with other 90% Cities, which explores design solutions addressing challenges that are created by rapid acceleration in urban informal settlements.

Fig. 3: Interior image of Yerwada slum before redevelopment
(Source: Prasana Desai Architects)

Fig. 4 : Proposed development
(Source: Smithsonian Copper-Hewitt)

CONCLUSION

Dharavi was not successful due to variety of reasons and the government is still struggling to work out the model. It is observed that the people living in Dharavi have more area under their occupation as opposed to government's norms resulting in the scheme not acceptable to the stake holders. Secondly, apart from their living, the stake holders have a thriving cottage industry at the same location which results in their not accepting the segregation of living and occupation. Thirdly, people have done incremental housing by which they have other source of income i.e rented income which they are not ready to give up.

Yeravada in Pune was successful as the stake holders had been identified and had biometric identification. No new stake holder was allowed into the scheme. Secondly, it was in-situ development where the pucca houses were integrated with new pucca houses in place of katcha houses. The houses were provided with kitchen and toilet facilities. Thirdly, these were financed both by the government and the stakeholder hence they had a sense of belonging. Finally, they continued to live in the same community space and so were happy with their new and improved living conditions.

Similarly, in Delhi slum rehabilitation projects on the outskirts of the city came up but even after taking those developed plots, the slum dwellers came back to squat at the same place or elsewhere thereby nullifying the government's good intentions. This has helped in now formulating new policy where it is recognised that city will attract migrants and they have to be accommodated. And the migrants would like to stay close to their place of work. Secondly, the slums that are existing have to be rehabitilated rather than dismantled as that will not serve the purpose of congested and unhygeinic habitations. All over the world it has been observed that in situ development suits better than relocation.

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MAKING URBAN INDIA SLUM FREE THROUGH INNOVATIVE LAND MANAGEMENT

Dr. Rashmi Ashtt* and J.K. Gupta**

Abstract

Large population base coupled with massive rural-urban migration is promoting rapid urbanization in India. Considering the limited capacity and resources available with local bodies and parastatal institutions, cities are fast growing in an unplanned and irrational manner, unable to provide basic amenities of life, including shelter to its inhabitants, leading to mushrooming of slums. Considering slums as the shadow of urbanization, rapid urbanization has also lead to mushrooming of slums in urban India. Every sixth urbanite in India has been recorded to be a slum dweller.

At the root of the problem of slums is the inadequate availability of land which has critical role and importance in providing adequate housing. With India having only 2.4% share of global land and 16.7% of population to support, land resource in India is highly stressed. Coupled with limited land and high degree of speculation, urban land prices have sky- rocketed. Since land is the major determinant of the housing cost, accordingly making housing affordable requires land cost to be minimized. Reducing land cost would call for making land market more efficient. In addition, cost effective housing would require providing adequate land, at right place in right quantity and at right price.

Minimizing land cost for creating affordable housing for slum dwellers, would require innovative options to be explored and put in place. For sourcing land at minimal cost paper would explore the options of making landowners partners in the urban development process; using the mechanism of land pooling and land redistribution; promoting guided urban development; rationalizing land records; optimum utilization of government lands; promoting public-private partnership; regeneration of existing derelict urban land; taxing vacant urban land; using land as a resource, creating efficient legal frame work; redefining urban planning and rationalizing building bye- laws & development controls etc.

INTRODUCTION

With merely 2.4 percent of the land and more than 17 percent of the world's population, India represents a unique example globally in terms of land-man ratio. Nation's population that was placed at 1210 million in 2011, is estimated to grow to 1400 million in 2031 and 1600 million in 2051. Further, urban population is estimated to grow to 600 million in 2031 and 800 million in 2051 as against 378 million in 2011. Massive growth of population has enormous social, economic, physical, infrastructural and environmental implications besides providing appropriate shelter for the poor . Providing appropriate shelter for the poor assumes importancebecause housing has been recognized, as basic human necessity contributing substantially to human livability and productivity. Housing has also been accepted globally as an important indicator of growth and development of a nation and quality of life it bestows on its citizens. Considering the role and importance of housing as a basic essential, World Assembly of Nations (Habitat – II) took the opportunity of endorsing universal goals of "Ensuring adequate shelter to all and making human

**Principal, Hindu school of Architecture and Planning, Sonepat*
*** Founder Director, College of Architecture, IET Bhaddal, Punjab*

settlements safer, healthier, more livable, equitable, sustainable and more productive".

INDIAN HOUSING SCENARIO

Globally, developing nations suffer from the perpetual problem of housing shortage with supply not keeping pace with the demand. The situation assumes alarming situation due to ever increasing number of urban migrants. Poor migrants, with inadequate financial resources, put pressure on land, urban services and infrastructures, which inevitably lead to congestion, increase in number of pavement dwellers and growth of slums and squatter settlements. The growth of slums is a sign of inability of people to afford land and shelter through the normal market mechanism and failure on the part of public sector to ensure equitable access to the poor. As per Census 2011, 65 million people were living in slums and squatter settlements. Nearby 38 percent population in metro cities was found to be in declared slums with Calcutta, Bombay and Delhi recording higher proportions. Poor quality housing coupled with absence of adequate water supply, disposal of human waste and garbage collection with 40 percent of urban dwellers left without access to safe drinking water and over 90 percent without access to safe sanitation are the general characteristics of these slums. Considering the present scenario of rapid migration and urbanization, slums are likely to house major chunk of future urban population.

Parallel existence and development of formal and informal housing stock and settlements in urban India, City within a City- a multiple city syndrome, is a phenomenon seen all over the developing world. Slums rubbing shoulders with housing of the rich are a classic testimony to the process of urbanization, which has thrown up "Islands of Affluence in a Sea of Poverty". With housing shortage placed at 18.8 million dwelling units (with more than 96% in EWS/ LIG categories), sourcing adequate land for housing the poor appears to be most challenging task. Indian housing market is beset with problems like ever growing shortage of housing stock for urban poor, lack of basic infrastructure , overcrowdings, poor quality housing, multiplicity of squatter colonies, mushrooming of slums, high land cost, scarcity of serviced land, lack of resources etc.

LAND RELATED ISSUES

Land, basic platform of all human activities, is considered most critical component of any housing. Despite the fact success of any housing program is contingent on availability of adequate land, still majority of developing countries have not been able to increase the supply of serviced land in urban areas. Land cost has become excessive and unaffordable. Intervention by the public agencies has not produced the desired effect in achieving the objective of supply of adequate serviced land at affordable price, to meet the needs of the shelter for the poor Accordingly, over the years availability of land has emerged as the greatest roadblock in providing appropriate shelter.

Land market in past has been controlled by the public sector and government had the virtual monopoly. With inefficient legal framework and lack of adequate resources available with the parastatal agencies, supply of the serviced land has become highly skewed. Excessive governmental controls have restricted the role of private sector in bringing adequate land into the urban market. Accordingly, most of the land available in urban areas is both unauthorized and unserviced. This has lead to the creation of a parallel urban land market, beyond the control and ambit of any regulated system. The share of informal land market has been steadily increasing making most of the land available in urban market un-serviced and city growth illegal. Treating land as a commodity, new paradigm of land speculation has lead to large tracts of urban land remaining vacant for number of years. With land prices going up steadily, capacity of the government to intervene effectively in the land market has been considerably eroded. Limited availability of land with public agencies has further reduced the supply in the urban market. Land acquisition through new legal framework has become a major hurdle which has made Development Authorities incapable of supplying serviced land in the urban market at an affordable price. Development Authorities have

also made land as the sole mechanism of making huge profits. In the process only a limited supply of developed land is made and the prices of released land go up considerably. Monopolizing land and restricting supply of serviced land coupled with its high pricing has edged out the urban poor from the urban market resulting in illegal occupation of public land in their search for the shelter.

In-efficient functioning of land market has its genesis in the non-involvement of private sector. With more than 90 percent of housing stock still being supplied by the private sector, its potential needs to be fully exploited. This becomes all the more critical due to limited availability of resources with public agencies and the ever growing demand for serviced land. From its role of "sole suppliers", public agencies should become facilitators" in making the urban land market more efficient by giving increased role to the private and co-operative sectors. State should remove all roadblocks, which hamper the efficient functioning of these sectors. Planning tools like Master Plans, Development Plans, Development controls and building by-laws have emerged as the greatest hindrance in the operation of land market. They require objective study, review and modification for making them promoters of orderly growth and efficient functioning of land market.

National Seminar on Future Cities, identified following issues hampering provision of affordable shelter to the urban poor :

- Reduced supply of land despite increased demand.
- Higher costs making land unaffordable for urban poor.
- Haphazard and premature exploitation of peripheral lands.
- Out-pricing of the urban poor from the land market.
- Proliferation of squatter settlements, haphazard and unplanned growth.
- Irrational land use controls.
- Unrealistic legal and regulatory framework.
- Focus on higher/middle income housing
- Locking government/private lands in inefficient uses.
- High degree of land speculation.
- Poor land information system/high transaction costs.
- Limited public agencies capacity to acquire large parcels of land.
- Non-involvement of private/co-operative sector.
- Irrational planning tools.
- Exclusion of urban poor from city planning/ development process
- Mechanism of auction to dispose off land
- Low priority to land for housing poor
- Large government levies
- High registration Charges
- Promoting plotted development instead of flatted development
- Irrational land development norms
- Non- availability of rational land parcels
- Large scale litigations and cumbersome legal framework
- Multiplicity of agencies involved working at cross-purposes
- Absence of dedicated land for the urban poor

STRATEGIES

Globally, housing for the urban poor remains most formidable challenge and accordingly housing strategies for the poor need a holistic and multi-pronged approach. For effectively addressing the

issue, increased supply of developed land and its availability in equitable and sustainable manner would be vital. The existing inequity in access of land to poor has to be removed. Policies must free the restrictions on land supply and make the land market efficient and sensitive to their demand. National Report for Habitat-II suggested following strategies to improve availability of land for the urban poor:

- Minimizing monopolizing or pre-empting land assembly, development and disposal by parastatal agencies.
- Land development made a joint activity of public/private/ cooperative sectors with adequate safeguards to protect the lower income groups.
- Directing public agencies towards increasing the supply of serviced land with preponderant proposition for the poorer section.
- Promoting optimum utilization of land
- Developing an automated cadastral/land titling system.
- Rationalizing legal framework.

UNCHS suggested following strategies for increasing supply of land for housing low income disadvantaged groups by:

- Appropriating vacant public lands.
- Acquiring land through the private market, at a price based on the present productive income.
- Trading land/development rights for land in alternative locations.
- Freezing land prices in specific locations.
- Pre-empting the sale of land when the value declared by its owners is under-valued.
- Appropriating land in lieu of taxes on inherited land.
- Appropriating land at lower than market value through the use of development gain taxes.

Above options are area, city and country specific depending upon the political agenda, government setup, legal and administrative framework, social structure, political will and commitment to the cause of weaker sections of the society. Looking at the entire context and prevailing trends, different options for strategizing sourcing of land for housing of the poor in the Indian context can be summarized in terms of:

Cross – subsidization

Cross-subsidization, as a mechanism for sourcing land, has been effectively used in Hong Kong where problem of low affordability of the poor has been resolved by leveraging the public/private sector resources. Cross-subsidization to the extent of 45% of the market value of housing for urban poor has been made possible through the mechanism of comprehensive urban development/re-development programme which capitalizes on increase in land values due to continued re-development of the city of Hong Kong.

Inclusionary Zoning

Manydeveloped/developing countries have used the system of inclusionary zoning for making available land and housing to the poor. Under this, a product mix of houses/plots is to be provided by defining a percentage of plots/houses to be made available for the low-income categories at affordable price. In case of Haryana all private developers are required to provide 20 percent of plots for the EWS category, at a price fixed by the State government. In state of Punjab, under the Punjab Apartment and Property Regulation Act, 1995, every developer is required to provide 10 percent of total residential area for the EWS. In case of apartments, 10 percent of apartments are to be provided for EWS category. However, this proportion needs to be increased with all restrictive conditions removed and land made available should be used for creating built-up houses. In this manner, large housing stock can be created for urban poor.

Squatter Zones

Integration of the informal sector with the urban planning process needs to be effectively leveraged to source land for shelter etc. In the Development Plans, sufficient area needs to be identified for the housing of the urban poor/ rural migrants, which can be acquired/developed to provide housing with basic infrastructures. Houses can be constructed and upgraded by the poor over a period of time. For the success of the scheme, sufficient funds need to be generated from different sources. Repayment scheduled needs to be linked to earning of the migrants.

Land Bank

Creating a land bank ,with all approvals, would be critical to facilitate the process of making available affordable shelter. Provision can be made to earmark 5-10 percent of the land in every urban development project for housing the poor. This land can be placed at the disposal of public authorities to be utilized for construction of housing for the poor

Land Pooling and Redistribution Schemes

These schemes involve landowners being treated as coparceners in the urban development process with no compulsory acquisition of land involved. Schemes generate enough land for public purposes/resources for infrastructure development besides bringing large amount of potential land, falling on the urban fringe into the land market. This helps in keeping the land price stable and imparts efficiency to the land market. Under the plot re-constitution mechanism large amount of land has been brought into the urban market in Ahmadabad city alone. P.R. Scheme is popular in India and has been successfully employed in the states of Maharashtra, Gujarat, Tamil Nadu, Punjab etc. Scheme needs to be leveraged in other states also to make land available for housing the poor.

Guided Urban Development

Under the World Bank assisted project in the state of Tamil Nadu, CMDA collaborated with private developers to built 10,000 units for EWS/LIG people. Under these schemes, owner/developers having land and agreeing to provide 75 percent of the plots for EWS/LIG categories were given exemption from Urban Land Ceiling Act. Though project did not make much headway but with certain modifications' can be effectively used for improving the availability of shelter to the poor.

Private Sector Involvement

Keeping in view the limitations of the public sector, it is necessary to encourage the private sector in large-scale assembly, development and disposal of land to supplement the efforts of public agencies. Haryana State has taken a lead in this regard by evolving a comprehensive and effective framework for sanctioning of colonies, which has brought in lot of reputed builders in urban centers. Haryana model needs replication with certain modifications in order to attract developers in small and medium towns. Developers have not only contributed substantially to the orderly growth and development of urban centers but have also made available large number of plots for the urban poor at an affordable price. Haryana has also evolved an innovative affordable housing policy where private developers, having land, have been provided with number of incentives involving higher density, FAR, height, rebate in levies and development charges etc to provide affordable housing on a pre-determined price for pre-determined area of flats.

Public-Private Partnership

The combined strength of both public/ private sectors can be effectively used in providing shelter to the urban poor. State of West Bengal has taken a lead by floating number of joint venture companies between West Bengal Housing Board and reputed private sector companies like Peerless Group, Ambuja Cement etc. Under these JV's, large stock of houses created for LIG/EWS categories on a highly subsidized price. The subsidy is made good through HIG housing and commercial sites. Lucknow Development Authority allotted land to the private developers, who were required to provide 40 percent of the plots for EWS category to be handed

over to the Development Authority for disposal to urban poor at a heavily subsidized price.

Regeneration of Urban Land

Lot of public and private land is locked in inefficient uses in the urban areas in the shape of closed industries/offices/institutions/derelict buildings etc. In order to make optimum use, it is essential that such land parcels are brought into urban market and used for meeting the requirements of housing for public/urban poor. State of Punjab has already launched a scheme called, 'Optimum Utilization of Vacant Government Lands (OUVGL)', under which all unused and under-used potential public lands are being identified, planned, developed and disposed off for housing/commercial purposes. This has not only generated resources for the state for infrastructure development but has also brought in considerable amount of land into the urban market. Part of resources generated/land needs be used for housing poor in the State.

Taxing Vacant Urban Land

Speculation in land as a phenomenon has gained enormous currency. This process has put on hold large quantity of serviced urban land. In order to bring this land into the market, it would be desirable to tax the owners of such land. The tax liability should be heavy so as to act as deterrent for keeping the land vacant. This would serve dual purpose of land being brought into urban market and also generate resource, which can be utilized for funding the housing for the poor. PUDA has imposed extension fee on the vacant plots after three years of allotment @ 2% of current allotment price. This has resulted in rapid construction on plots lying vacant for number of years besides generating resources, which can be leveraged for creating housing for poor.

Efficient Legal Framework

For improving the supply of serviced land in urban areas, existing legal framework needs close scrutiny/drastic amendments. Amended Land Acquisition Act has made the land acquisition both costly, time consuming and expensive. Law needs to be reviewed to ensure availability of adequate amount of land at affordable price for housing the poor. Rent control law also needs rationalization to create more housing stock.

Building Bye-Laws and Development controls

Effective and optimum utilization of valuable urban land is often hindered by the existence of archaic/outdated building bye-laws/development controls, which impose undue restrictions on the efficient use/development of the land. Rationalizing development controls and building restrictions relating to FAR, mixed land use, height, plot size, room height etc will help in optimum utilization of land and improving housing stock for the poor.

CONCLUSION

Considering the enormity and magnitude of problem and declared policy of government to provide housing for all by 2022 and launching number of innovative schemes by the state/national governments for affordable housing, making India slum free will largely depend upon our capacity to leverage land in right quantity, at right place and at right price.

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HOUSING AT THE CENTRE FOR SUSTAINABLE FUTURE OF CITIES

Dr. Ashok Kumar*, Sayantani Lala, Dr. Kishor Kulkarni** and Vijay Raj Deopa*****

Abstract

Housing is imperative for socio-economic development and a basic right to lead a dignified life. However, the urban poor, who constitute about 30% of the total poor in the country, are most deprived of this entitlement. They consist of mostly migrant workers, who have shifted from villages to cities in search of better livelihood. Yet in reality their economic condition barely improves. With informal settlements like slums being their default dwellings, the urban poor have limited access to basic services like sanitation, drinking water and health services.

With the expected urbanization reaching the 50% mark in about 20 years, the cities are in dire need of revamp in order to accommodate the growing population according to the principles of sustainability. Hence, for inclusive development of the huge populace of urban poor living without a proper home, it is pertinent, that the 'Housing at the Centre' principle, which underlines a holistic approach to urban planning, be adopted in India. It shifts from the idea that a house is a separate entity constructed only for shelter to a more sustainable concept of a house being a part of a planned network, which contributes to overall improvement of the quality of life of the citizens. This paper discusses the concept of the 'Housing at the Centre' principle, with comparative case studies, to identify and propose solutions to the bottlenecks in the process.

INTRODUCTION

The significant transformation of the rural- push and urban- pull in search of better livelihoods and amenities has triggered the process of urbanization as one of the most significant global trends in the recent decades. However, the issues and challenges around housing have not received adequate attention in the urbanization process. According to UN-Habitat [1], this rapid urbanization has contributed significantly to the large number of urban poor, almost synonymous with the slum-dwellers residing in the metropolitan cities. The proportion of urban poor has increased globally from 689 million in 1990 to 881 million in 2014, with southern and south-eastern Asia having an approximately 80% increase in the population of urban poor in the given timeline. There are manifold reasons behind this rise, the main being unplanned urban spaces and inadequate singular policies, and non-availability of alternative livelihoods in non-urban areas.

In order to address this growing problem, the principle of 'Housing at the Centre' has been mandated by the UN Habitat, to promote urbanization which is both sustainable and adequate. It has sought to develop an integrated framework for planned urbanization and has focused efforts to restore the role of housing for the future of sustainable urbanization. At the very heart of this principle lies the in-situ development of the slums and its inhabitants, with accessibility to basic services like water and toilets. In contrast to the previous outlook which supported rampant urbanization as the engine of development, this new concept includes the principles of sustainability as part of urbanization and seeks to act as a transformative force which can potentially lead the world to overcome challenges

** Senior Principal Scientist, ** Scientist, *** Project Assistant; CSIR- CBRI, Roorkee*

related to inclusive development and climate change.

India, as a developing country is no exception to rapid urbanization. The number of urban agglomerations /towns in India has grown in the last century from 1827 to 7935 (1901-2011). The total population has increased in the same period from 23.84 crore to 121.02 whereas percentage of population residing in urban areas has increased from 10.84% to 31.16% [2], with approximately 65 million people living in slums [3]. It is estimated at the beginning of the 12th Five-year plan, India has a housing stock shortage of 18.78 million [4]. Set to become the most populous country by 2022, it is essential that the housing policies of India reflect the 'Housing at the centre' principle for tackling the impending pressure on the functionality of the cities. At the national level, it should account for integration of housing into National Urban Policies and strategic thinking on planned urbanization; whereas at the local level, the approach should account for the in-situ development and improvement of the built environment of the cities.

EXISTING HOUSING POLICIES IN INDIA

In India, a number of housing policies at the national level have already been formulated, with the first kind of social housing taking shape in the early 1950s, as part of various schemes of the 2nd five year plan like Subsidized Industrial Housing, Low Income group Housing, Middle Income Group housing, Slum clearance and Sweepers Housing [5]. This was followed up with state-led Environmental Improvement of Urban Slums [6] and Sites and Services Scheme [7] in the span of 1970-1990s, however without much success owing to ineffective integration as part of the urban development, social and economic policies.

After the economic liberalization in 1991, a more inclusive approach was adopted. The National Housing Policy, 1994 sought to increase supply of land used by basic minimum services thereby promoting a healthy environment. It was followed by The National Housing & Habitat Policy, 1998 which laid greater emphasis on the aspect of quality and affordability of "Habitat" as a supplementary focus to housing, especially for the economically weaker sections (EWS). The current version, The National Urban Housing and Habitat Policy, 2007, provision was made for balanced regional development, with the objective of developing a symbiotic rural-urban relationship, which formed the basis for the Town & Country Planning Acts of some states. It seeks to enhance the spotlight on 'habitat' with a 'Regional Planning approach' as, by (1) Earmarking of land and housing stock for the EWS/LIG groups in new housing projects and (2) New integrated townships catering to EWS, envisioned in order to form a growth-conducive ecosystem in the cities [8]. In addition to this, The Two Million Housing Programme (TMHP), the Valmiki Ambedkar Awas Yojana (VAMBAY) and the ambitious Jawaharlal Nehru National Urban Renewal Mission (JNNURM), 2007 were launched to provide housing for the EWS by subsidizing housing stock and fulfill basic gaps in infrastructure relating to water, sanitation, sewerage, drainage and roads.

To complement the housing policies, The Government has also launched schemes from time to time to improve the quality of life. The National Slum Development Programme (NSDP) had provisions for adequate and satisfactory water supply, sanitation, housing, solid waste management, primary and non-formal education. The Swarna Jayanti Shahari Rozgar Yojana (SJSRY) was designed to provide employment to the urban poor by encouraging setting up of self-employment ventures and wage employment opportunities for families below poverty line in urban areas.

However, despite the numerous housing policies over the years, India has lagged behind in providing this basic need. The housing schemes have not been successful owing to a number of bottlenecks. In order to identify the problems, some case studies have been conducted, the observations of which are discussed below.

CASE STUDIES

The National Capital Region (NCR) has been selected as the location for conducting the case studies. The NCR is a major economic hub undergoing swift urbanization. People of all economic classes all over the country migrate to the region in search of better fortunes. The urban poor population is of significant number here and hence numerous slums have cropped up. Moreover, this has served to be the pilot ground for major Government schemes and hence provides for an ideal sample set for numerous surveys. The proximity of the city to

the place of study has also been a major factor for deciding upon the location.

Three areas have been surveyed under this study. The first one is a slum called Kathputli Colony, in Shadipur, which is in the process of insitu-development by DDA. The second is an upgraded slum called Ekta Vihar, in Sector 6, RK Puram, where in-situ development had occurred in 1989. The third is a colony of low-cost affordable housing in Bawana, where urban poor from various areas all over the city have been rehabilitated.

Case Study I: Kathputli Colony in Shadipur

- The site had been selected for in-situ development of slum dwellers by DDA in 2009 but owing to a number of problems, it is still nowhere near completion in 2017 (Fig.1).
- The inhabitants migrated from Rajasthan, majority of who were performing artists like street dancers, magicians, puppeteers, gypsies etc. However, now only 40% of the performing artists remain. The area is infamous for housing petty criminals.
- For the process of the in-situ development, the inhabitants are shifted first to a transit camp in Anand Parbat Industrial area, and will be rehabilitated at the completion of the project. 546 families have already been shifted while 2800 families are still remaining. However, all people in the region are not in support of the project.
- People opposing the project fear eviction from the area. Mostly uneducated, they are unable to interpret the papers provided to them by the DDA. They also demand separate homes for each married couple in a family.
- According to the DDA officials present in the area, such fears of forged papers are unfounded. Out of 20 sub communities living in this region, 16 have already agreed to the proposal and 4 are still doubtful and hence the delay for the project.
- A number of social ills like child marriage, unplanned family and little or no schooling are prevalent here. Living conditions in this area are dire, with narrow broken roads, open drains, partly demolished Jhuggi Jhupri, uncovered garbage area, no proper toilets and waterlogged infestations of mosquitoes and flies. According to the officials, the transit camps are in far better shape than this area. However, the locales still feel that they are better off here than in any other new place.

After assessing the area it can be derived that the locales do not trust the government officials and fear eviction. This insecurity is taken advantage of by certain persons, who might have vested interests and hence the project is getting unnecessarily delayed. However, there is an immediate need for redevelopment of the area with improvement in sanitation and awareness about social ills of child marriage and unplanned conceptions.

Fig.1: Kathputli Colony: Open Drains and Water Logging Around Houses
(Source: DDA)

Case Study II: Ekta Vihar in R. K Puram

- The inhabitants here are from Rajasthan and belong to the same caste as those of Kathputli colony. The total population is around 4000 in 472 houses, of which there are 2200 voters.
- This site has already been in-situ developed in 1989, where all the Jhuggi Jhopris has been replaced with masonry houses. Floor area of each house with verandah is 12.4215 sq.m. It consists of a single room and kitchen. The land was bought at a price of Rs 5000, which was later written off by the Government. The houses are in the names of the women to prevent misuse of the property. After initial development, the inhabitants have increased the number of floors on their own. In 1995,

the roads inside the area were further developed under the incumbent government and an NGO, named Asha has also worked significantly in improving the condition of the area.

- People living here are involved in marriage, party arrangements and small-time businesses like grocery and stationery shops etc.
- The condition of this colony is better with wider cleaner in-roads and electricity. Most of the children are sent to school. However, major problems in this area are unavailability of drinking water, insufficient community toilets and poor sewerage cleaning. The people have agreed to pay for the drinking water, but to no avail. There is only one community toilet, consisting of 4-5 seats for the 4000 people living in the area. For the cleaning of drains, only two sanitary workers are appointed whereas according to the locales, there is requirement of 13-15 sanitary workers.

After assessing the region, it is noted that the area fares a lot better than the Kathputli colony on account of the development in 1989. However there is still scope for further improvement (Fig.2).

Fig.2 : Ekta Vihar Slum in R.K. Puram, New Delhi
(Source: Asha NGO)

Case III: EWS Colony in Bawana

- This colony has been built around 2010 in the Bawana industrial region. EWS and Urban poor from many areas like Sarojini nagar, Golemarket, Bangali Camp, Palam, Khan Market, Safdarjung etc. are rehabilitated in this colony.
- The colony consists of two types of houses, built with the RC Plan and Joist system of CSIR- CBRI, Roorkee, one with frame-structure and another with load bearing walls, with floor area of 35-45 sq.m. Total numbers of apartments built are 3164 + 1184 = 4348. The colony is partly occupied with a lot of the apartments lying vacant.
- Most of the people are content that they have been rehabilitated to a cleaner environment and proper house, however some feel that they were better off in slums. This can be linked with the limited livelihood options in the current location. Bawana being an industrial region, the only means of earning is working in factories, whereas in the main city other options like household employment were available. The earnings also are significantly lower. Compared to INR 14000-16000 before, they now earn INR 4000.
- There is seepage problem in the top floors, owing to improper execution and maintenance by the concerned organizations, in this case DSIIDC. In addition to this, there is drinking water problem in the region. According to the locales, per day 12-15 rupees are spent in buying drinking water, which is rather expensive for them.
- Although most of the colony is clean, there are areas where roads are of the same state as any undeveloped slum area and again in need of proper maintenance.
- Apart from these, some of the people have sold/rented the houses to dealers/builders and hence the purpose of allotting the houses to EWS is lost. Some of the apartments are also being used as commercial establishments like shops, which is again illegal.

Hence it can be inferred that providing houses only are not enough. In order to ensure that the purpose of rehabilitation is served, proper service, maintenance and inspection are necessary components of the process (Fig.3).

Fig. 3: Typical Apartments (G+3) for the Rehabilitated EWS at Bawana

SUMMARY OF CONTEMPORARY PROBLEMS AND PROPOSED SOLUTIONS

Problems

After conducting the case studies, a number of problems have been identified, which should be incorporated as part of the title approach for proper functioning of housing policies.

- While building houses or townships for urban poor, it should be realized that they are economically the weaker section. However, in the practical scenario, even if they are provided with a shelter according to the provisions of any policy, they are located in the outskirts of the cities. For the EWS, to commute daily from their houses to their place of work, with a recurring transportation cost is unthinkable. So even if houses are being built for the EWS, rarely they are benefitted because the other factors such as livelihood, connectivity and location disadvantages are not taken into account when housing complexes are sanctioned. Hence, even if they are allotted to some houses, they prefer to give the same on rent and shift back to slums, nearer to their workplaces. Therefore, despite the Government spending millions on the housing schemes, the slums are ever growing and the policies fail.
- Another major problem is lack of proper amenities and poor maintenance. Even in the cases of developed housing for the slum-dwellers, drinking water and sanitation facilities are unavailable. The internal environments of the colonies are continually deteriorating due to lack of maintenance.
- There is also a fear of uncertainty amongst the slum-dwellers concerning their future. Despite the Government policies sanctioned for their benefit, they are unable to trust the officials and fear eviction. This may be due to a number of reasons, the root of which is lack of awareness and communication gap between the urban poor and the Government officials.
- The final problem in the way of development of urban poor and hence as an extension to the housing schemes, is the lack of social acceptance. It is a widely perceived notion that slum dwellers are always segregated in social circles and generally not accepted in economically prosperous society housing. Hence their housing policies are also formulated keeping in mind this detrimental distinction.

As a part of this perception towards the urban poor, a survey has been conducted among the residents of NCR, regarding their thoughts about inclusion of these people in their housing societies. There had been 131 responses, a summary of the results of which are presented below.

Table 1. Summary of Results

Parameter	Options	Responses	Percentage (%)
Age Group	18-25	35	26.7
	26-35	81	61.8
	36-45	10	7.6
	46-60	5	3.8
Occupation	Professional	92	70.2
	Business	9	6.9
	Homemaker	4	3.1
	Student	26	19.8
Income Group	LIG	41	31.3
	MIG	56	42.7
	Super MIG	27	20.6
	HIG	7	5.3

Residence Type	Single family detached house	39	29.8
	Apartment (Independent floors in single building)	55	42
	Apartment (Large Society Housing)	37	28.2
Accommo dation of Maids	Nearby slums	51	39
	Same building	14	10.7
	Maids not employed	52	39.6
	Not in nearby locality	14	10.7
Accomm odation of other unorganized work force	Nearby slums	53	40.5
	Ignorant of their living areas	56	42.7
	Not in nearby locality	22	16.8
Comfort level if separate apartments in the society/ locality are allotted to the urban poor	Strongly oppose	7	5.3
	Oppose	14	10.7
	Neutral	54	41.2
	Support	39	29.8
	Strongly support	17	13

The responses can be grouped into three types. Those in support, think that social inclusion of these people is the best way for development, and feels that EWS should have access to better living conditions. Apart from this, easy accessibility to the services catered by EWS also tilts the stakes in favor of the affirmative answers. Some opinions are neutral, even apprehensive. These people strongly opine that they are in support of such an arrangement as long as adequate safety measures are taken within the colony, without the deterioration of internal environment. 84% of the people who have taken part in the survey belong to these two groups, with majority in support. However, of the 16% which oppose the move, feels that a gap should be maintained between the living areas of the EWS. Several reasons are cited, like security concerns, social status and deterioration of the built environment. It is to be noted, that no amount of measures can allay the insecurities of the people who believe in maintaining social class divisions. Only with time and social inclusion can such repressiveness be dismissed.

Solutions

The solution for all these problems lies in the holistic approach to housing needs. The cities especially are in dire need of this principle to manage the huge populace of unorganized sector living without a proper home. (Fig. 4)

- In-situ development: Instead of relocating the urban poor from their place of residence, it is more effective if in-situ up-gradation of the existing slums is conducted. As the EWS and LIG are habituated to live in a particular area, it would be better to improve the living conditions there, instead of trying to shift them to a different location. This should especially be taken care of in metro cities where the urban poor constitute a major percentage of population. According to 2011 census, about 40% of the population in Mumbai, and 30 % each in Kolkata, Chennai and 15% in New Delhi live in slums [9]. In addition to slums, LIG people also live in massive houses with bee-hive like apartments and common toilets, known as Chawls, which also bear some cultural significance. Instead of demolishing them, it is always better to upgrade them to a more comfortable living space based on the lines of the Plattenbau renovation in Germany [10]. However in cases where the in-situ development is not feasible (for example under the bridges, flyovers etc.), the next best option is to find nearby lands for construction, so that the livelihoods of EWS are not severely affected.

- Secondly, a beneficiary led construction of houses would address, firstly, the problem of livelihood of the EWS, for a certain time. Secondly, the finer traits of the human nature would cause the invariable attachment of the work force to the houses being built, knowing that it would belong to them on completion, thus preventing the further renting out to the third parties for commercial purposes.

- However, it is not enough to provide houses alone. The availability of basic amenities like drinking water and toilets should be ensured. Also, the maintenance of the newly built or upgraded areas is an equally important task to ensure a healthy living environment. In the event of poor maintenance, even the upgraded colonies can revert back to the original unhygienic conditions, thus defeating the entire purpose of rehabilitation. A stringent inspection and maintenance framework should be in place, maybe with the involvement of the inhabitants for improvement of living conditions in these areas.

- Subsequently, the only way to allay the insecurities of the EWS is to create awareness amongst them. This can be done by facilitating workshops, exhibitions and small informative seminars in their locations about the various Government policies in their favor. For the uneducated, it is pertinent that the technical documents regarding their tenancy be clarified by each clause to be understood in entirety. Some officials should be delegated full-time for this purpose. Only through continuous support, the mistrust of the slum-dwellers can be cleared, which will further pave the way for all-inclusive development.

- Ultimately, progress can only be achieved by inclusion of these marginalized groups in the mainstream society. Often they are quarantined from social gatherings; a counterproductive conduct, reflected in both their development and Government housing policies. As mentioned before, according to The National Urban and Habitat Policy, 2007, at least 25% of the new houses built, should be earmarked for the EWS category [11]. However, this 25% is rarely realized in the housing colonies.

Fig. 4 : Schematic diagram of Issues and Remedies at hand.

CONCLUSION

Over the years the role of the Government has gradually changed from the physical provider of houses to a facilitator of the housing requirements in terms of finance and partnerships. However, with the 'Housing for All by 2022' policy launched in 2015, the Government is coming to a full circle. This scheme which addresses the mass housing problem in both rural and urban areas, has set a target of building 20 million houses by 2022 for the urban areas [12]. It has addressed some of the bottlenecks of housing schemes, following the core principle, even though there is scope for improvement. Its provisions includes (i) In-situ Slum Redevelopment with private sector participation using land as resource (ii) Affordable Housing through Credit Linked Subsidy (iii) Affordable Housing in Partnership with private and public sector and (iv) Beneficiary led house construction/enhancement. However, the success of this program depends solely on effective implementation, which remains to be seen.

From this paper, it can be inferred that the 'Housing at the Centre' principle, does not speak only about providing permanent shelters to the urban poor. It also aims at improving the built environment

and certifying an all-inclusive development of the community. An important component in this regard is the social inclusion of the marginalized EWS to secure the success of the housing policies. However, in order to ensure an integrated development, the local authorities should also vigilantly prevent the spurting of new clusters as well as effectively monitor the up-gradation process. Hence, a housing policy following the principles of 'Housing at the Centre' with simultaneous two-track approach of curative and preventive provisions against the growth of informal settlements needs to be in place for the realization of the housing-for-all dream.

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AFFORDABLE HOUSING AT NAVI MUMBAI - CASE STUDY

Sonali Rahul Talele*

Abstract

On account of substantial increase in the cost of flats/tenements and acute shortage of affordable houses, especially category EWS and LIG categories, in Mumbai Metropolitan Region, and in particular in Navi Mumbai, there is huge demand for affordable houses. Therefore, CIDCO has embarked upon an ambitious programme to construct houses in Navi Mumbai at various locations to cater for different people in society. Further, to cater for the EWS and LIG categories, the planning earmarked certain plots in Sector 36 at Kharghar. The Swapnpoorti scheme was completed in the year 2016.

The paper gives details of the above mentioned Affordable Housing Project executed by CIDCO.

INTRODUCTION

This project has been developed in urban area, for EWS and LIG category. The plot reserved only for EWS and LIG scheme under city development in CIDCO LTD., Navi Mumbai. CIDCO partly subsidized the project land for increasing affordability for economically weaker section and low income group people.

On account of substantial increase in the cost of flats/tenements and acute shortage of affordable houses, especially category EWS and LIG categories in Mumbai Metropolitan Region, and in particular in Navi Mumbai, there is huge demand for affordable houses. Therefore, CIDCO has embarked upon an ambitious programme to construct houses in Navi Mumbai at various locations to cater for different people in society. Further, to cater for the EWS and LIG categories, the planners earmarked certain plots in Sector 36 at Kharghar. The Swapnpoorti scheme was completed in the year 2016. Also CIDCO have taken up the EWS and LIG scheme at Taloja-Panchanad, Kalmboli and Ghansoli for such houses which are to be completed in next five year.

The prefab industrialized construction technology was adopted for the work of design and Construction of EWS (Economically Weaker Section) and LIG (Low Income Group) type tenements with shops and on-site infrastructure works for "Swapnapoorti" scheme in Sector 36 Kharghar, Navi Mumbai.

After approval in board meeting, the layout plan for scheme consists of 3590 nos. of EWS/LIG type tenements in 54 buildings, LIG type 32 nos. buildings and EWS type 22 nos. buildings, with 66 shops, 10 kiosks and 8 stalls on ground floor of LIG type buildings facing 35 m wide road. The total plot area is 7.97 Ha. The total BUA of construction is around 23.06 lakh sqft.

The carpet area of EWS type tenements is 307 sqft. as per CIDCO (City and Industrial Development Corporations) norm and for LIG type tenements is 370 sqft. as per CIDCO norm. The total cost of project including infrastructure work is 55383.87 Lacs.

BEST PRACTICES ADOPTED IN THE IMPLEMENTATION OF THE PROJECT

Technology of Construction

The 3S (S- Strength, S- Safety, S- Speed) Prefab technology having structural RCC members has been adopted. The major precast elements are RCC hollow columns with notches, RCC solid beams

*Assistant Engineer (HSG-II), CIDCO, Mumbai

('T'/L/Square Shape), Staircase, RCC precast slab, AAC precast slab, AAC precast block.

This 3S prefab construction technology is being used in multi storied construction up to (G+14). This technology has been currently used in mega housing projects of MHADA (Maharashtra Housing and Area Development Authority) and CIDCO (City and Industrial Development Corporations) and DDA (Delhi Development Authority). This technology has been successfully used for last 40 years.

In this system, precast dense concrete column shell of appropriate size are used in combination with RCC shear wall, interconnected with precast dense concrete rectangular/ T shape /Inverted L shape beams, Siporex or precast RCC slabs (as per design demands) for floor and roofs.

The structural components i.e. precast hollow columns, beams, lintel with chajjas, stairs and precast slabs and wall panels are casted in factory/ casting yard (factory like controlled conditions) and subsequently erection and concreting at site.

These components are erected, aligned and connected using self compacting concrete of appropriate grade along with secured embedded reinforcement. The core of columns and beams tops thus get fully concreted after erection with appropriate grade of in situ self compacting concrete. All the connections and jointing of various structures are thus accomplished through concreting along with secured embedded reinforcement of appropriate size, length and configuration to ensure 'wet jointing' method of monolithic continuous resilient ductile and durable behavior.

All vertical load bearing elements of frames are tied at every floor with prefabricated Siporex or precast RCC slabs having topping of minimum 40 mm thick reinforced cement concrete screed, acting as rigid horizontal diaphragm. The column beam joints are rigid joints and are detailed accordingly. The lateral forces are transferred to the shear walls and precast column beam frame through infinitely rigid slab beam diaphragms.

This 3S Precast technology consists of RCC structural earthquake resistant frame structure with proof checking from IIT Bombay, Mumbai.

Innovative Dwelling Unit, Building Plan and Layout

The G + 14 for LIG type and G + 7 for EWS type storey buildings reflects the environment free design elements typically followed in individual tenements.

Specious entrance lobby are provided with two lifts for G+14 buildings and 1 lift for G+ 7 buildings, two staircase, fire fighting system, refuge area are provided at eight, ten and twelve floor as per fire norms.

The typical dwelling unit design provides one living room, one bed room, one Kitchen, one toilet and one Bath room with Carpet area of 34.35Sq.M. (370 Sq. Ft.) for LIG types and 28.22 Sq.M. (307 Sq. Ft.) for EWS types per dwelling units. Storage spaces (Loft) are provided in kitchen and Bed room, also the cupboard space and niche below windows are provided in Living room and Bed room.

The fire fighting shaft, electrical shafts, tel. cables shafts were provided. The separate meter room was provided at ground floor.

The commercial shops where provided in grounds floors of LIG type buildings with separate toilets. The maximum shops were provided on the main roads frontage.

Separate society office is provided in condominium. Watch man cabin is provided at main entrance gate.

Building Work and Tenements

Structure

RCC Framed Structure [EWS(G+7) and LIG(G+14)] with Earthquake Resistant Design, with cast-in-situ foundation, precast structural members and Siporex slabs/ precast RCC slabs.

Wall

Siporex Block / Precast Concrete Block walls had been provided. The external wall 150 mm thick and internal wall 100 mm thick. These wall are light weight and economical.

Plaster

Internal – Single coat cement-sand plaster with cement-sand mix in proportion of 1:4 and by adding shrinkage compensating admixture and water proofing compound for improving anti cracking property. The thickness is 12 mm Cement plaster with POP finish has been provided.

External – The 23 mm thick Sand Faced Plaster with additional base coat with fibers was provided to entire external surface of all buildings, sub-station, watchmen's cabin, society office, compound wall etc. The first coat was of 8 mm thick in cement sand mix proportion of 1:4 and second coat of 15 mm thick cement sand mix proportion of 1:4.

Flooring and Dado in Tenements and Commercial Units

The Vitrified Tiles flooring (600 mm x 600mm) provided in Living room with skirting, ceramic tiles flooring (400 mm X 400 mm) provided in bed room, kitchen and passage with skirting, Antiskid ceramic tiles flooring (300 mm X 300 mm) provided in WC, Bath, Dado full height in Bath and 900 mm high in WC had been used in every tenement.

Antiskid Ceramic tiles conforming to Indian standard is used. Tiles are free from cracks, grazes, spots, chipped edges and corners. Variation in size shall be limited to + 1.5 mm.

Polished Kota stone flooring provided in Main entrance lobby and lobby area per floor and Staircase with skirting had been used in every building.

China Mosaic broken tiles mix color pieces finishing with water proofing treatment on terrace has been provided in every building.

Door

For LIG Type Buildings main door is polynorm door-frame and shutters with wood veneer finish, FRD (2 Hrs. Fire Rating). For EWS Type buildings main door Polynorm door frames and door shutters with wooden veneer finish. Brass chromium plated fittings and fixtures for EWS and LIG.

Bedrooms Door is Polynorm door frames and polynorm door shutters with brass chromium plated fittings and fixtures, WC / Bath-FRP Shutters with marble frame for EWS and LIG. Safety door provision is provided for main door frame of tenements. Rolling Shutters is provided in shops.

Window and Grill

Aluminum Anodized with Green Marble Frame, 5mm thick clear glass and M.S. grills is provided for EWS and LIG tenements window.

All aluminum material is 20 micron anodized for protection against corrosion in marine atmosphere.

The steel grill was provided to windows, ventilators. The weight of gill is 15.00 kg/sqm. The grill was painted with one coat of anti-corrosive paint.

Kitchen

Black polished Granite stone platform with stainless steel sink, Full height dado above Kitchen platform is provided in both EWS and LIG.

WC

EWC Wall mounted with flushing cistern of 6 liter whit 4 liter half flush capacity, jet spray (Flush) is provided in each LIG type tenements, Shops toilet, common area toilet and every physically challenged citizen resaved tenements in LIG and EWS buildings. Indian Orissa type WC Pan with flushing cistern of 6 liter whit 4 liter half flush capacity, bib cock is provided in EWS type tenement.

Bath

The Concealed GI Pipes with Seiko or equivalent fittings wall mixer is provided in each tenements.

Painting

Internal Wall: The Oil Bound Dispenser 2 coats are applied on external wall in tenements and lobby of EWS and LIG tenements.

External - The water proofing cement paint/ 100 % elastomeric outstretch paint was applied on buildings.

Ceiling: The White Wash applied on fall ceiling of all tenements, shops and lobbies.

Staircase

Two closed staircases is provided per building with Kota stone treads, risers, mid-landing and landings, RCC pardi with M.S. railing, RCC jali for openings, Staircase Doors at every floor of buildings is FRD (2 Hrs Fire Rating).

Electrical

The Concealed Copper Wiring with modular switches, Exhaust point is provided in Bath, W.C. and Kitchen, Geyser point is provided in Bath. One TV Point, One Telephone Point and One Internet Point provided in Hall of every tenements. Also air conditioner point is provided in each bed rooms of LIG tenements.

Surroundings of Building

Landscaped Area

- Open space was 10.79% of total area of plots. It is used for garden, tree plantation and open space as per the guideline of GDCR (General Development Control Regulations).
- Benches were provided in the garden for senior citizens.
- Children Play area was provided with play equipment.
- One open parking space for four wheeler, every 4 tenements and additional 10% parking for visitors was provided. Also10 % two wheeler parking was provided.
- Under ground water tanks is provided as per grouping of building and overhead water tanks per building was provided with sufficient nos of pump houses.
- Building layout as per the directions of wind circulations and sun rotations. Every tenement was fully ventilated.
- Electrical sub stations, D.G. sates, watchman cabin at main two nos.entrance gates of plots was provided.

Rain Water Harvesting

Total 5 nos. of rain water harvesting tanks was provided to improve and maintain the ground water quality because area is under saline water zone.

Storm water from plot area was collected in the rainwater harvesting pits. These pits were constructed for collecting, filtering and recharging ground water through percolation pits.

Infrastructure in Surrounding of Building

Roads

The bituminous roads were provided in internal area of building premises. The width of road is 6m.

Storm Water Drain

Proper storm water drainage facility was provided. It is adequate size, to collect the rainwater on road and top of the buildings. The network of storm water drain from garden, parking areas, paved, unpaved area, and water from terrace was diverted though rain water harvesting recharging pits and excess water was passed though the storm water drain.

Sewerage Network

Sewerage line network was collecting the sewage from each building through sanitary pipe line. This internal sewage network was properly connected to the main sewerage line of CIDCO sewerage network.

Water Supply Network

Adequate water is supplied through CIDCO main water supply network. In this scheme 8 underground water tanks and pump houses are provided cluster wise. Water collects in underground water tank, then water is supplied to the over head water tank though submersible pumps. The underground water tank, an overhead water tank and submersible pump is provided adequate sizes. These underground and over head water tanks having two separate parts one is fire tank and other is domestic tank as per the Central Public Health and Environmental Engineering (CPHEEO) manual of water supply. The 24 X 7 hrs. water is available in each tenement through down take network of water supply.

Solid Waste Management

Solid waste collected from tenements was segregated, the biodegradable and non biodegradable wastes were stored in different colored bins. This waste was composed at Kalmboli, the handling by CIDCO's Public Health Department.

Fire Fighting System

The pressurized automated system with underground and over head tanks / pumps, etc. sprinklers in stilts, and lobbies of (G +14) and (G + 7) buildings, hose reel at each floor, and fire hydrants around buildings provided as per CFO norms.

Electrical Work

Electrical sub stations, D.G. set back up is provided to building lifts and lobby lighting at the time the electricity is off. The condominium lightings, pump house service provider room is provided in campus of buildings.

Lifts

The 10 persons capacity schindler lifts were provided. The lift enclosures is for 2 hr. fire rating as per relevant IS code.

LIG: 2 Nos./Bldg. – 10 Passenger, 1.5 MPS, V3F Drive, ARD,Fire lift.

EWS: 1 No. /Bldg. – 10 Passenger, 1.0 MPS, V3F Drive, ARD, Fire lift.

Price of Selling

Types	Carpet Area of tenements	No. of Tenements	Unit sale price
EWS	28.63 Sq.M (307 Sq. Ft)	968	INR. 15.78 Lakh. Onwards
LIG	34.36 Sq.M (370 Sq. Ft)	2622	INR. 23.93 Lakh. Onwards
Total		3590	

Comprehensive Maintenance of "SWAPNAPOORTI" Scheme

(i) The general defects liability period for the items is one (01) year in order to have better housekeeping within layout, a comprehensive maintenance period of 05 (Five) years including defect liability period. It starts from the date completion of work.

(ii) During this comprehensive maintenance period of five years, the contractor is performing the following maintenance jobs, at no extra cost to the Corporation.

- Maintenance of pumps electrical and mechanical items including replacement of consumables and parts.
- Comprehensive lift maintenance five years including replacements of parts.
- Replacement of damaged / broken / vandalized items.
- Daily cleaning of common areas, building,

including, door-to-door garbage collection.

- Maintenance of garden and horticulture works including all labour and tool and supply of manure, red earth and replantation of damaged shrubs / lawns.
- Security for initial period of 6 months is included in the cost but thereafter will attract payment as per the actual deployment of security persons.
- During the comprehensive maintenance period of 5 years, the contractor will arrange to hand over the allotted premises to the beneficiaries in good condition without any extra cost to the Corporation.

(iii) Payments towards water and electricity consumption shall be paid by the occupants as per actual.

Attachments

- Dwelling Unit plan
- Overall layout project.
- Photographs of Scheme.

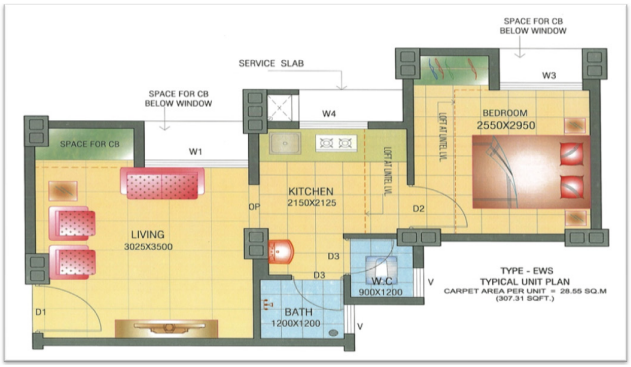

Fig. 1: EWS Type Dwelling Unit

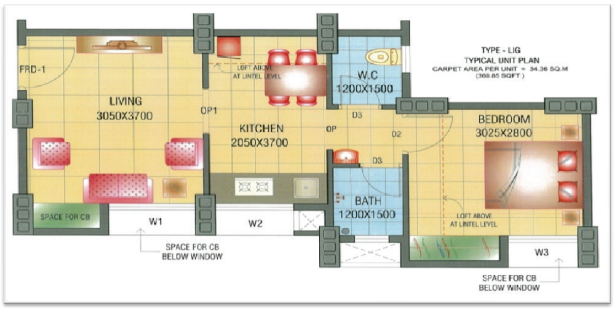

Fig. 2: LIG Type Unit

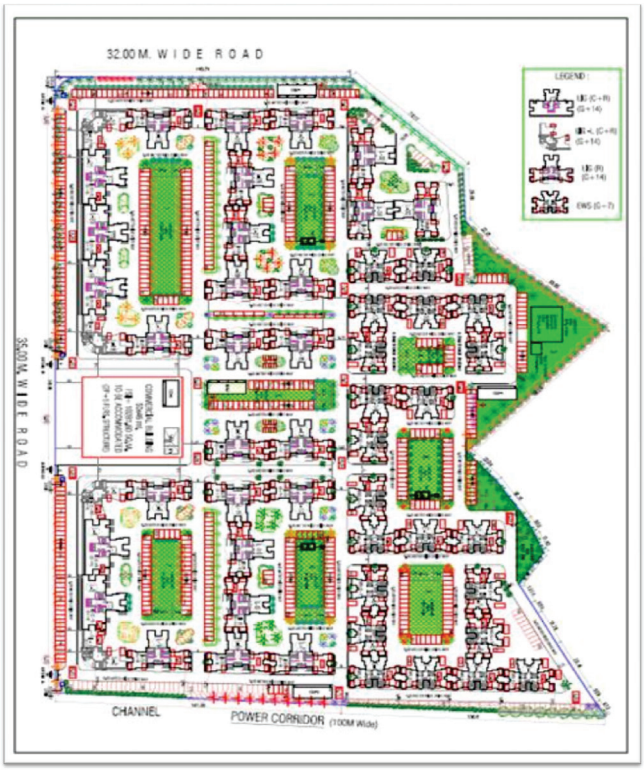

Fig. 3: Layout Plan

Fig. 4: Showing Roads

Fig.5 : Parking Area

Fig.6: Children Play Area

Fig.7: Pump House

Fig.8: Society Office

Fig. 9: LIG Building Lifts

Fig. 10: Physically challenged People Building Entrance

Fig. 11: Commercial Shops

Fig. 12 : Main Entrance Gate of Scheme

CONCLUSION

The project of EWS and LIG housing tenements with shops and on site infrastructure works in sector 36 at Kharghar, Navi Mumbai with 3590 nos tenements has been a very well implemented low cost housing project. There is need to take up such projects all over the country for addressing the problem of Housing for all in India.