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# To Study the Construction Techniques for Slum Rehabilitation in Metro Cites

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**ABSTRACT:** With increasing urbanization, the need for adequate affordable shelter also increases. Housing shortage is one of the major challenges faced in developing countries like India. It is imperative to provide housing that caters to all income groups with special focus on the low and middle income groups. In order to provide low cost housing, it is essential to adopt innovative sustainable technologies which are affordable, fast track, cost effective, durable as well as environment friendly. This seminar discusses emerging innovative technologies that can be adopted in the country to lower housing construction cost and help in provision of mass affordable housing. Some of the technologies discussed are Tunnel form, Sismo building technology, Light Gauge Steel Framed Structural technology, Precast Sandwich Panel technology etc. These technologies are reviewed on various parameters like local availability, affordability, energy efficiency, structural stability, quality, speed, cost effectiveness, eco friendliness and suitability for high rise construction. The advantages and limitations of the technologies are also mentioned. The seminar highlights the potential barriers for adoption of these technologies in the Indian urban scenario and methods which can be employed to overcome those barriers in order to provide affordable housing for the low and middle income groups. Fast track construction is very much essential for the mass housing projects like slum rehabilitation. For this rapid wall technique can be best option for construction.

**KEYWORDS:** urbanization Mass housing, Fast track construction, slum rehabilitation .rapid wall

## I. INTRODUCTION

The population in India already constitutes 17.5% of the world population and continues to grow at a rate of 1.4% annually. At the same time India has seen a gradual change of policing from decentralization to urbanization in the succeeding five year plans, as heavy-industrialization and commercialization are given increasingly more impetus compared to agriculture and agro-based industries. These factors have resulted in a growing trend of rural to urban migration in the nation. 2 The metropolitan areas however do not have the infrastructure required to accommodate these huge migrating populations. These factors have caused the rise of a new section of population: the urban poor. Most of these urban poor translate into a squatter community. Slum pockets have emerged throughout the cities of the nation. The development of the democratic thought in the recent years has brought the issue of right to housing for poor to the forefront. This thought has seen the government of India take efforts to accommodate the squatters and alleviate their quality of life by implementing various schemes.

### **Need of Mass housing for Slum Rehabilitation:**

Mass housing (MH) represent the leading pattern of urban transformation and expansion in the second half of the 20th century, and accordingly evaluation, regeneration and redesign of the MH represent a necessary and challenging task in the contemporary research context. In the practical scope of MH rehabilitation, various holistic approaches and design strategies are identified that affirm both ecological transition and social transformation of these urban settings. However, the level of application of such approaches across Mumbai varies greatly.

**Current Scenario:** India is a young and growing economy. It is estimated that India's urban population is going to be doubled by 2030 (580 million) from its urban population of 2001(280 million). The construction of houses in India is mostly carried out by private players. If we understand the implication of these two facts on the construction industry by large and the role it will play in coming decades, then a lot of perception about it will change.

“It is estimated that India had about 280 million people living in the cities and towns in 2001. Let's say at an average of 5 persons per house it works out to 56 million houses. So if we say that the urban population is going to double in by

2030 it means we need another 56 million houses to be built. In other words we need to build almost same number of cities and towns that we had in 2001, by 2030. That takes us to the next question: Who is going to build it and how they should be built?

If we look at how we developed our towns and cities over last couple of decades, we feel it is a disaster barring a few pockets in terms of urban planning, infrastructure and building designs. We will all agree that we do not want to repeat the same mistakes in next 20 years. Also if we think rationally it is only people, who are already in the age group of 25 to 30 plus, who will build most of these new urban developments “Now some thoughts need to be put up on, how do we as architects, town planners and other professionals along with construction and infrastructure industry, partner to face this challenge and successfully achieve the objective. We can have a multifaceted approach to solve this puzzle. As town planners, architects and designers we can look at our past performance and learn from our mistakes. Some of them are lack of concern and sensitivity for environmental impacts ,There is a need to understand the importance of public transport system and integrating them with private development.Going back to the fact that most of these new constructions will be done by private players. For private players doing large scale projects : the importance of water supply, sanitation and solid waste disposal and supply of electricity in sync with government and local bodies will be very crucial for the success of these developments. Creation of a platform where a number of private players and industry professionals come together to create a common vision for developing a particular part of the region is also very crucial. We can expect some amount of direction from Planning authorities and from the Government. However, collaboration between them and private players would be the ideal situation in ensuring overall success

#### **Significance:**

Housing is an essential aspect of sustainable development. Through its construction, design, use and demolition, housing contributes to the consumption of natural and man-made materials resources, water and energy. As sustainable development is highly interlinked with the concept of quality of life, well-being and liveability , sustainability measures are increasingly at the forefront of housing provision efforts as housing is a significant tool to deliver both quality of life and sustainable development. The imperative of climate variability means that people's housing technologies and design need to be more sustainable in reducing their contribution to greenhouse gas (GHG) emissions . Sustainable housing is expected to improve energy efficiency, ensure access to safe drinking water, sanitation and hygiene, and reduce waste and water pollution. These structural and design elements of housing, alongside other housing components such as housing location, environment and expenditure burden, can, directly and indirectly, affect people's choices and chances to improve their quality of life.

## **II. METHODOLOGY**

### **Method Of Mass Housing For Slum Rehabilitation**

The threat of climate change caused by the increasing concentration of greenhouse 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 CO<sub>2</sub> emissions. Building construction causes CO<sub>2</sub> 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. Rapidwall, also called gypcrete panel is an energy efficient green building material with huge potential for use as load bearing and non load bearing wall panels. Rapidwall 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 Rapidwall panel in 1990 in Australia, it has been used for buildings ranging from single storey to medium - high rise buildings. Light weighted Rapidwall has high compressive strength, 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. Rapidwall buildings are resistant to earthquakes, cyclones and fire.



**Manufacturing of GFRG panel**

Phosphogypsum which is a byproduct of phosphoric acid plant is calcined in calciner at 140-1500 C at the rate of 15MT/hr of calcined plaster. This calcined plaster is stored in product silo having capacity of 250MT. The plaster is then transferred to batch hopper by screw conveyors and through Entoleter in wall panel manufacturing area. This area consists of 6 casting tables having dimensions of 3m x12m, one crab having mixer and glass roving delivery system is for delivering slurry and glass roving for three tables. The chemicals are added in water & mixed and then plaster is added & mixed to form slurry. One layer of slurry is laid on the table by the crab followed by a layer of glass roving. This glass roving is embedded in to the slurry with the help of screen roller. Another layer of slurry is poured followed by a layer of glass roving this layer is pushed inside the ribs with the help of temping bar. Finally a layer of glass roving is laid for the top face of the wall panel. After getting final Gilmore wall panel is lifted from the casting table to ACROBA frame and shifted to dryer for drying. The wall panel is dried at a temperature of 275°C for 60 minutes. After drying, the wall panel is either shifted to storage area or on the cutting table. The wall panel is cut as per dimensions supplied by the consumer and the cut pieces are transferred to stillages which are specially made for transporting wall panel. The liquid effluent generated during manufacturing process is recycled back in the system for manufacturing of new wall panels. The solid waste which is generated while manufacturing wall panels is recycled back to the calciner after crushing and separating plaster & glass roving in recycle plant. The above system is a batch process. Six wall panels can be manufactured in eight hour shift per table. Similarly, 36 wall panels can be manufactured in eight hour shift with 6 tables. Flow diagram of the system showing the manufacturing process is attached herewith.

**Inspections & Testing:**

It shall be done at appropriate stages of manufacturing process. The inspected panels shall be stored & packed to ensure that no damage occurs during transportation. As part of quality assurance regular in process inspections shall be carried out by the trained personnel of the PAC holder.

Physical and Material Properties:

**Rapidwall** panel is world’s largest load-bearing lightweight panels. The panels are manufactured with size 12 m length, 3m height and 124 mm thickness. Each panel has 48 modular cavities of 230 mm x 94 mm x 3m dimension. The weight of one panel is 1440 kg or 40 kg/sqm. The density of the panel is 1.14g/cm<sup>3</sup>, being only 10-12 % of the weight of comparable concrete /brick masonry. The physical and material properties of panels are as shown in following table 3.2.1

Weight	44 Kg/ sqm
Axial load capacity	160 kN/m { 16 tons/ m }
Compressive strength	73.2 Kg/cm <sup>2</sup>

Flexural strength	21.25 kg/cm <sup>2</sup>
Tensile Strength	35 KN/ m
Fire resistance	4 hr rating withstood 700-10000 C
Elastic Modulus	3000-6000Mpa
Water absorption	< 5%

The vertical and lateral load capability of Rapidwall Panel can be increased many fold by infill of concrete after placing reinforcement rods vertically. As per structural requirement, cavities of wall panel can be filled in various combinations (See Fig.2.)

**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. Various construction joints are illustrated in Fig.3.

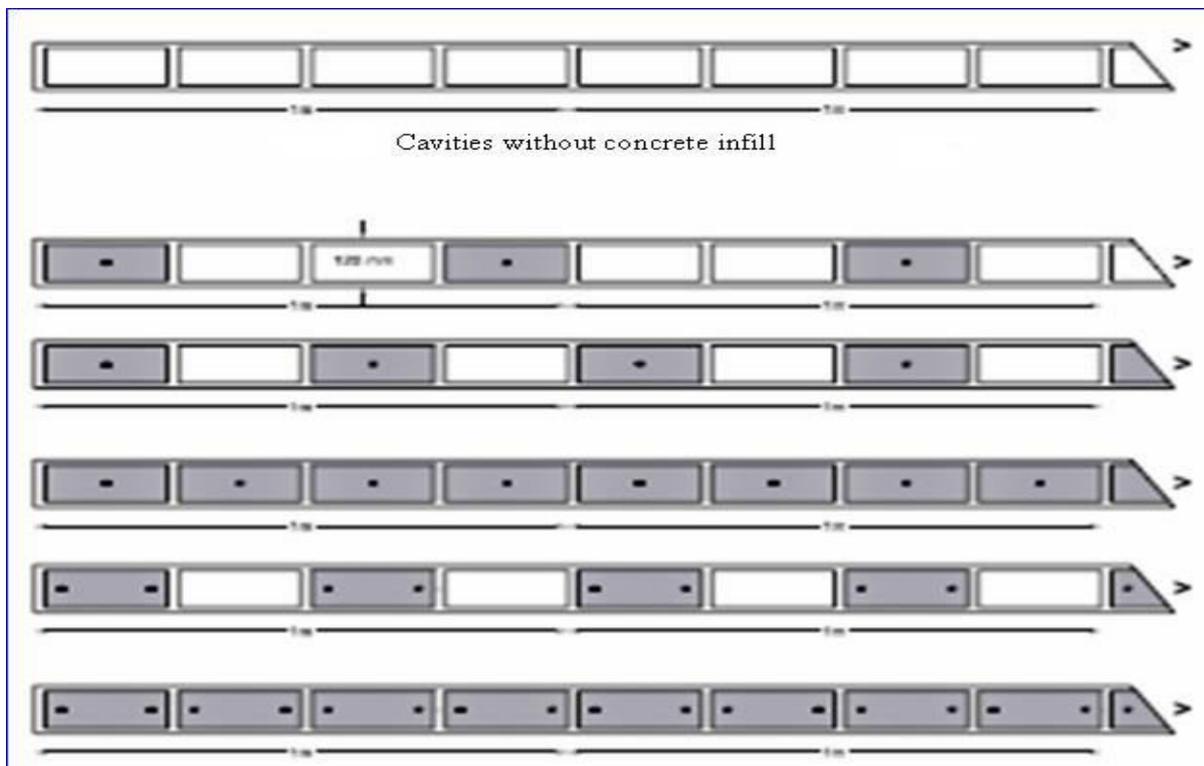


Fig.1.2 : RCC infill to increase load capability

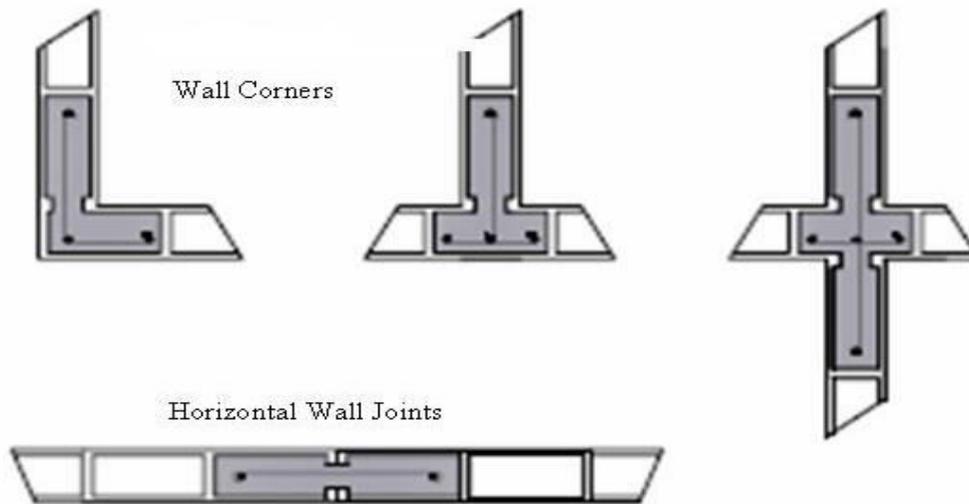


Fig.1.3 Various construction joints

Rapidwall Panel can also be used for intermediary floor slab / roof slab in combination with embedded RCC micro-beams and RCC screed concrete (Fig.4).

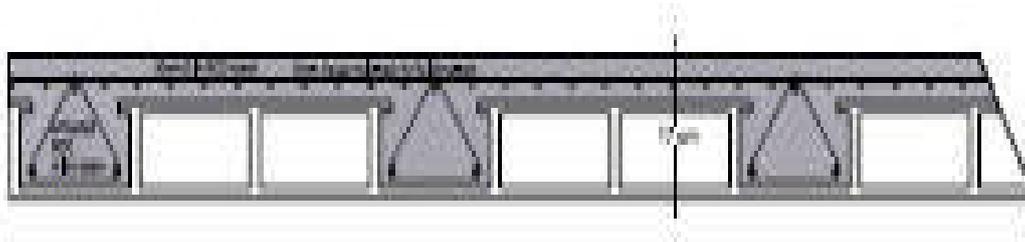


Fig 1.4. GFRG embedded with RCC micro beams and RCC screed concrete

**Rapidwall:**

Rapidwall enables fast track method of construction. Conventional building construction involves various time consuming processes, like i) masonry wall construction ii) cement plastering requiring curing, iii) casting of RCC slabs requiring centering and scaffolding and curing iv) removal of centering and scaffolding and v) plastering of ceilings and so on. Construction time is minimized to 15-20% by the rapid wall method. Instead of brick by brick construction, Rapidwall enables wall by wall construction. Rapidwall also does not require cement plastering as both surfaces are smooth and even and ready for application of special primer and finishing coat of paint.

**3Openings:**Door/window, openings will be cut and reinforced concrete is provided there.



**Comparison:**

Comparative study of Rapidwall building and conventional 2storey 1500 sft Building:

Materials/ items	Rapidwall Building	Conventional Building	Saving in %
Cement	16 tons	32.55 tons	50.8
Steel	1800 kg	2779 kg	35.2
Sand	20cum	83.37cum	76
Granite	38cum	52.46cum	27.56
Bricks	-	57200	
GFRG panel	500sqm	-	
Water	50000ltr	200000ltr	75
Labour	389 mandays	1200 mandays	67.59
Construction time	21 days	120 days	82
Wt. of superstructure	170 tons	490 tons	65
Construction cost	Rs 13.25 lakhs	Rs 18.27 lakhs	61.5

**III. CONCLUSION**

Fast track management has got wider acceptability primarily due to time saving approach It is very much essential in mass housing . Moreover some other benefits like Catching up the backlog, Leaping quickly into emerging markets, Reduce construction costs, Savings through advance purchase, Closer collaboration are also significant. On one side where we find advantages we also find some disadvantages like that of quality issues, planning issues, unrealistic client expectations associated with fast track construction that are probably the reasons for fast track construction not becoming the automatic choice for constructing any type of projects. One of the implications as per our review of the fast track project is an additional risk in various domain. The main challenge in construction sector is to create certainty about delivery on time, on budget and to the targeted quality and safety. Fast track construction is a solution for the problem. Fast tracking strategies are used to achieve shorter project duration. Different types of strategies are affecting the fast track construction. Delay management, resource management, choice of technology is the three different important strategies that affect the fast track construction. The most important causes were delays in fast track construction are contractor's payments, shortage of material in construction, change in material, etc. Without proper Resource management projects can fall behind schedule or can become loss. The application of latest technology at construction industry will help to complete the project with short duration. Different methods are available in each strategy for their betterment and their application will helps for the success of a construction.

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