Use of Schnell Construction Technology as an Alternative to Low Cost Housing in India

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***Abstract* — In this paper an attempt has been made to understand and look for use of Schnell Construction technology to be used as an alternative to the conventional technique of building construction for construction of low cost housing for Low Income Group in India. A comparative cost analysis has been done between the two methods and further application and prospects of Schnell technology for construction of LIG housing has been discussed in detail.**

Keywords* — *Schnell, LIG, Construction, Low cost Housing

I. INTRODUCTION

Housing is one of the essential human needs along with food, clothing and education. In spite of the rapid stride in the field of building technology, providing shelter to millions at an affordable cost remains a distant reality in most of the developing countries across the world.

Housing for the urban poor in India has failed to keep up with the rapid urbanization. This has led to low-income families living in cramped, sub-standard and often rented accommodations with limited access to civic amenities. The Government of India estimates a shortage of more than 18 million homes, of which 95% are in the housing for Economic Weaker Sections (EWS) and Low Income Group (LIG) segment, an income class with families earning up to INR 16,000 per month. Many of the EWS and LIG families cannot afford privately built housing unless the Government provides some subsidy. There are also a large proportion of urban low-income families, with a monthly household income of INR 10,000 – 25,000, who can afford privately built formal housing costing INR 4 – 10 lakh without any aid from the Government. There is an estimated need of 15 million homes for these low-income customers, which translates into an opportunity of INR ~9 lakh crore for developers and INR ~7 lakh crore for housing finance companies. (Agarwal, Jain, & Karamchandani, 2013) According to the Monitor Research report by CRISIL Infrastructure on NHB trends in housing in India, there is a potential demand of 22 million housing units in India with an estimated market size of Rs. 1,100,000 Crores for 53% of rban residents in India earning an income of not more than Rs 20,000 per month.

Conservation estimates that 60% of total households in Monthly Household Income(MHI) in Rs 5000-20000 are renting and looking to buy a house of their own in the long run. Considering the fact that only 31500 housing units were constructed through 132 projects from June'11 to jan'13 (Hansa, 2013), it can be arguably said that huge strides need to be taken to catch up to the ever increasing demand of low cost housing in India in the next few years.

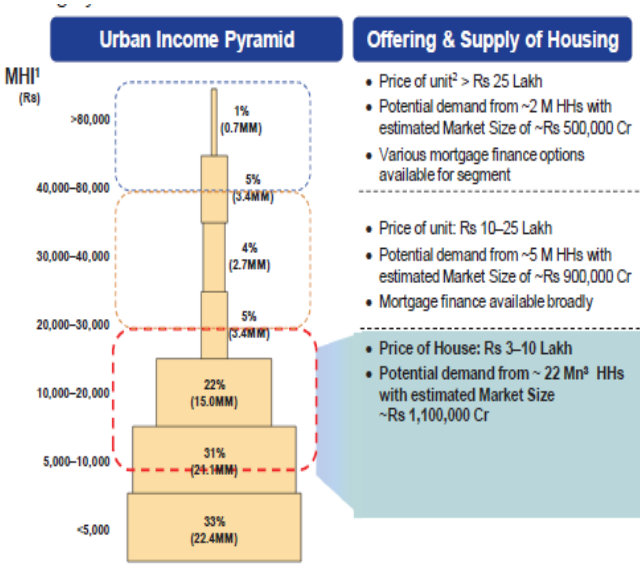

Figure 1: Trends in Supply of housing units with respect to monthly housing income (CRIS, 2013)

Many lower income households live in poor conditions and are dissatisfied with their housing situation, but their searches for affordable housing mostly end up being unsuccessful. The urban poor are trapped in poor and insecure living conditions which often consist of poorly constructed cramped houses with poor sanitary conditions, lack of basic infrastructure facilities and presenting a poor social environment to children.

Findings show that up to 60 % of the total cost of a low-income housing project is allocated to engineering design and construction materials. Moreover, walls constitute up to 50% of the total cost of materials and up to 45% of total construction time (Lal, 2003). Material origin, production techniques and labour requirements all have major impacts on the selection of wall building material. Better technical solutions regarding energy efficiency and environmental characteristics of a structure should result in houses with a quality that will improve the urban environment.

II. OBJECTIVES OF THE STUDY

The main objective of this paper is to build low cost / affordable high density multi-storey apartments using alternative technologies such as Schnell Construction technology and comparing with the conventional technique. It

can be noted here that there are many project designs and proposals nationwide that can be implemented but without implementation modalities or even enabling mechanisms for would-be beneficiaries to access them. This study proposal goes beyond design to attempt to propose appropriate mechanisms that can be used to have the beneficiaries access this finished project.

The specific objectives of the project are:

- To provide different models of residential buildings;
- To provide residential buildings built by sustainable, low cost and local building materials;

This study is limited to engineering design alternatives of building materials for walls, roofs etc of low-income housing projects. The primary reason for this limitation is due to the fact that the cost of this structural element reaches up to 50% of the total cost; secondary reason is that the construction of these components can take 45% of the construction time and finally have an indirect negative impact on the environment.

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III. INTRODUCTION TO SCHNELL TECHNOLOGY

Schnell House, an Italian company introduced a cost-effective housing construction technology capable of reducing construction cost by half compared to the traditional brick and mortar-house. The technology would be very much useful to avail affordable houses because no developer presently caters for the needs of the ordinary people. "In a bid to find a solution for the low income earners, there is need to be innovative and look for alternative ways for building, which are efficient and less costly" (Newtimes, 2013).

The Schnell Home construction technique replaces bricks and blocks of traditional construction system with polystyrene sheet panes, assembled together with welded wire mesh. The panels are finished on site by pouring or spraying concrete to get different structures of the building such as vertical walls, stairs and roof. The technology uses materials such as galvanised steel, wire mesh and compressed Styrofoam. The houses are built using panels all through. The houses are not only durable, but are also resistant from fire and natural tremors. The house withstands such disasters eight times higher than the traditional houses. The houses are also constructed in a shorter time with less labour. "A house, which would take six to seven months to be completed using the traditional materials, takes us only one month using this technology".

The Schnell Home technology is easy to install and fast in construction, saving time and cost. This technology is being effectively used for construction of housing quarters at Jindal Steel & Power Limited (JSPL), Angul, Orissa. When asked Mr. Dinesh Kumar Saraogi, Executive Director, JSPL, Angul about the success of Schnell at Angul, he replied, "It is very helpful for projects like ours as we can construct building very quickly and in a cost efficient manner". The system has several advantages, compared to the traditional system. The technology is more efficient in terms of time and cost. It reduces construction time by more than 50 percent. In comparison to traditional system, it also helps in saving cost to a considerable extent, besides saving the indirect cost by saving time. The buildings constructed with this technology are resistant to earthquake and cyclone. The technology provides heat insulation, reducing heat dispersion up to 60%. This helps in energy saving. The materials used in this technology are fully recyclable, thus it is friendly to the environment. Like traditional buildings, the buildings constructed with this technology are also strong durable.

The panels are undulated Expanded Polystyrene (EPS) sheets of varying density (15kg/m3 to 25kg/m3) sandwiched between two electro welded zinc coated wire mesh, which in turn are connected by 33 connectors per square metre thus giving us a 3 Dimensional statically indeterminate reinforced steel. For giving adequate strength to the panels, 35mm thick shotcreting is done on the panels surface using pumps at a pressure of 2kg/cm2. Making the panels incredibly light weight, these are easy and fast to install. It was practically observed on site that an area of 100m2 can be erected in 2 days using only 5 workers. Roof concrete pouring and shotcreting could be completed in 10 days with 5 workers. Consequently, finishing will be completed in 10 days with 4 workers

A. Steps of Construction

The following steps are observed to be carried out in the construction of buildings from schnell technique:

1. Fixing of anchors on the grade slab according to layout;
2. Wall panel erection (anchoring);
3. Checking the alignment of the erected panels;
4. Tying the different types of meshes so that the walls stand straight;
5. Erection of slab panels;
6. Shotcreting of walls, ceilings and slab casting;
7. Finishing.

The basic steps of construction of a building using the Schnell technology can be observed through the following images (Krishnakant, 2013):

Figure 2: steps of construction of a house using schnell technology

IV. COST ANALYSIS OF CONVENTIONAL AND SCHNELL SYSTEMS

For all engineering works it is required to know beforehand the probable cost of construction known as estimated cost. In preparing an estimate, the quantities of different items of work is calculated and from these quantities cost is calculated. The rates in the estimate provide for the complete work, which consists of the cost of materials, cost of transport, cost of labour, cost of scaffoldings, cost of tools and plants, cost of water, taxes, establishment and supervision cost, reasonable profit of the contractor etc.

As a part of a project done by final year students of OP Jindal Institute of Technology(OPJIT), Raigarh on "Low Cost Housing for Low Income Group", a comparative analytical study was done between the conventional method of construction and Schnell Construction technology for a G+2 building with 12 housing units having a total built up area of 9,615 Sq.ft. Most of the LIG housing units that have been built by the government in various cities across the country have been built on the same dimensions.

The comparison was done with respect to detailed estimation costs calculated for every major construction activity starting from earthwork, RCC work, MEP (mechanical, electrical, plumbing) works and finishing works as well as the materials costs associated with the construction of the building using both the methods separately. The summary of the costs can be observed in the following table:

	CONVENTIONAL TYPE		**SCHNELL HOUS-**	
Description	**Amount**	**Cost/ sft**	**Amount**	**Cost /sft**
Civil works	8,554,789	890	10,249,066	1,066
Plumbing Works	1,090,160	113	1,090,160	113
Electric-Al works	920,151	96	920,151	96
Total of al1	**10,565,10**	**1,099**	**12,259,377**	**1,275**
Total built up area (sqft)	9615.00		9,615	
Cost per sqft	**1,100(appr**		**1,275 (approx)**	

Table 1: Summary of comparative analysis between Conventional and Schnell construction techniques

Note:

The above cost has been arrived depending upon the available BOQ as per available Drawings, and the cost of erection of Schnell Panel has been considered provisionally. If any changes will be in future the cost will vary accordingly.

CONCLUSION

Though initial cost of Schnell technology is slightly higher than the conventional method but in comparison to traditional system, it helps in saving cost to a considerable extent, besides saving the indirect cost by **Saving Time**. The buildings can be constructed in less than 1/3rd time as compared to that of traditional construction technique which means more number of houses can be built in the same time duration. The government of India declared housing for all in 2010 and anticipated the building of 2 million low cost houses per year by the public sector in addition to ongoing housing construction in the private and informal sectors (Ogunwusi & Onwualu, 2013). For such Mass Housing Scheme, a large number of houses can be built through Schnell.

In addition to the cost of buying resources , cost of operations involved, and manpower required every project incurs some indirect costs in terms of overheads, administrative expenses, loss of revenue, profit etc. This indirect cost increases with duration.

Although the cost per square feet of Schnell technology is greater than the conventional construction method but it can be minimized by :-

- Using low cost electrical and sanitary fittings (closet, kitchen sink etc.);
- Mass construction of houses using this technology as the requirement of LIGs;
- Using various thin sections of Schnell panels (50 mm or 80 mm) in partition walls as well as in outer walls;
- Flooring should be provided by using low cost tiles;
- Going for 3-4 storey construction would be better than single or double storey.

Using these above mentioned alternatives, Schnell technology can prove as a very viable alternative for construction of LIG housing at a mass scale for the various housing schemes implemented by the Government of India. Providing a permanent house for the urban poor leads to a feeling of sense of upgrade in their lifestyle, a feeling of belonging, pride of ownerships and surge in aspirations, all positive sociological impacts which in the long run make it possible for them to be a part of the urban fabric in the same way as the rest of the people

REFERENCES

[1] Agarwal, A., Jain, V., & Karamchandani, A. (2013). State of the low income hoousing market.

[2] CRIS. (2013). NHB Trends in Housing. Hansa. (2013). Survey on Low Income Housing Supply in India.

[3] Jain, V. (2013). Privately built low income housing in India. Delloite.

[4] Krishnakant, J. (2013). Creative composite solutions.

[5] Lal, A. (2003). Handbook of Low cost Housing.

[6] Newtimes. (2013). Newtimes, Rwanda. Retrieved from www.newtimes.co.rw/

[7] Ogunwusi, A., & Onwualu, A. (2013). Prospects for multi functional utilisation of bamboo in nigeria. Raw Materials Research and Development Council, Abuja .

[8] Deb,A; Karamchandani,A; & Singh R.(2010). Building houses financing homes

[9] KPMG(2012).Building the Upper housing Shortage in india