Review Paper on "Modular Construction in High Rise Buildings"

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Abstract – Modular construction has been introduced since late 90's. During last 5 years this construction practice has slowly been familiarised in high storey structures in all over the world. The difficulties faced during construction makes modular construction more challenging in this era. There has been research that modular constructions reduces project design, time, cost and improve efficiency. Based on various case studies and thesis it concludes the design, engineering & sustainability, a developer would like to consider in adopting modular method in high rise structure. This paper discusses the development of modern modular construction methods in order to provide the population with reasonable, comfortable and sustainable housing. The paper defines the predictions and significance of introducing modular prefabricated units into multi-storey buildings.

Keywords: Modular Construction, High Rise Construction, Prefabricated Units.

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1. INTRODUCTION

The purpose of this paper is to study the ideas of construction of modular structure and to identify the technical factors which will boosts the modular construction in India. The amount of reports suggests that due to quick urbanization, there have been causing serious housing problems. The cities are growing unreasonably thus increasing the gap between poor and rich. The world communities are worried by the fact that 26 out of 34 megacities are developing nations. Modular technologies are widely used in low storey buildings, offices, workstations and even special premises. In modern industry construction can be distinguished i.e. the practice of separate frame elements (beam, column, flooring, wall panels, etc. that are produced offsite and joined onsite. The practice of 3-D blocks including necessary facilities, interiors. In this advanced world of construction, this method should be planned compared to traditional methods. Due to increase of population, it demands the supply of home is highest significances of construction industry. This reduces the time and this is only possible when new construction methodology is adopted by industry.

2. LITERATURE REVIEW

In 1994, **Mayra L. de la Torre[8]** offered theideanamed "A Review and Analysis of Modular Construction Practices" at Lehigh University. In this paper, Torre presentedbenefits and difficulties of modular construction activity at the time, and an engineering survey of modular construction.**Alistair F. Gibb[9]** Loughborough University, United Kingdom. This book describes the principles and the effect of this method on the construction industry. A theory by architecture **Joseph Schoenberg[5]** titled "A Case Study Approach to Identifying the Constraints and Barriers to Design Innovation for Modular Construction," submitted at Virginia Institute and State University in 2012which detects the problems based on other case studies.

3. CASE STUDY ON HIGH RISE BUILDING IN WOLVERHAMPTON, ENGLAND

A 25-storey modular project in Wolverhampton, England was studied to obtain facts on the construction process. It contains 3 blocks of 8 to 25 stories and in consists of 824 modules. The tallest building is Block A, which is shown in Fig.1

The total floor area of three buildings is 20730 m^2, including a podium level. The floor area of the modules represents 79% of the total floor area. The maximum size of module was 37m^2. The project started in July 2008 and was completed in August 2009 (59 weeks). After the completion of podium slab modules were started installing in October. Construction of concrete core was carried out together i. e Core A, B, C were carried in parallel.

Due to offsite construction storage of materials and on-site activities were less. Lightweight cladding was used on all buildings and contains a mixture of insulated render and composite panels, which are attached directly to the exterior aspect of the modules. The total area was 10440 $m^2$for all the 3 blocks [Lawson].

Fig1.25-storey modular building in Wolverhampton, England during construction (source:-By R. M. Lawson)

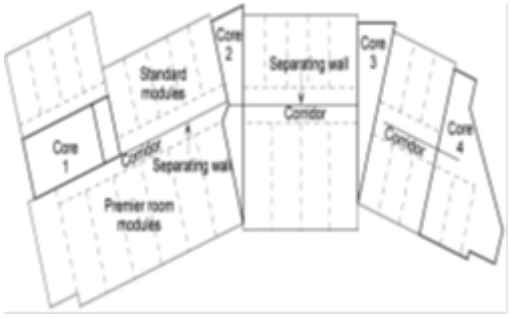

Fig2: Plan of modular building at Bond Street, Bristol, showing the irregular-shaped core positions.

(Source: Anonymous)

3.1 Construction Data

The weights of modules were between 10000-25000kg & self-weight was 5.7kN/m^2. The modules of block A & C were installed by mobile crane that was supported by concrete core. The installation time of 824 modules was 32 weeks and was managed undertotal8 people plus 2 site managers. The minimum installation rate goes up to 7 modules per day but sometimes it reaches 15 modules per day which corresponds to 15 men per modules. The overall construction team for the non-modular components varied from a further 40 to 110 with 3 to 4 site managers, increasing as the 59-week project progressed. It does not take into consideration the design input of the architect and consultants, which would possibly add about 25% to these total efforts. The modules which were at top 14% of total weight were due to steel components and 56% under concrete floor slab. At lower floors the weight of steel was increased to 19% of total modular weight. The steel usage varied from 66 to 118 kg/m^2floor area, which is higher than the 50 to 60 kg/m2 for medium-rise modular systems. The total estimated data of efforts of man with respect to construction of building was 35% manufacturing, 10% in transport and installation, 54% in construction of rest of building. The estimated productivity compared to in-situ construction increased about 75-80% [Lawson].

4. SCOPE

The scope of work is based on the site you choose. The modular building constructer should survey the site to find out utilities are available. The list also includes electric, water, phone installations, communication and other utilities.

5. RESEARCH

The main emphasis of recent researches according to various sources is to implement the modular construction in high rise buildings. Due to advancement of technology in construction materials and methods, many Chinese Companies are undertaking projects in modular buildings and have an ambition to complete in less than 90 days.

6. CONCLUSION

We can conclude that offsite construction is financial beneficial at project level. As we can observe due to implementing modular method the cost of material is reduced, it contributes to LEED requirements and it is included in sustainability of surroundings.

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