International Journal of Research in Engineering, Science and Management
Volume 5, Issue 5, May 2022
https://www.ijresm.com | ISSN (Online): 2581-5792

Planning of Residential Township with Prefabricated System at Ambivali, Kalyan

Aditya Shastri[1], Rucha D. Dumbre[2], Aditi G. Dorugade[3*], Hemangi R. Gangavane[4], Rashmi V. Wagh[5]
[1]*Assistant Professor, Department of Civil Engineering, A. P. Shah Institute of Technology, Thane, India*
[2,3,4,5]*Bachelor of Engineering, Department of Civil Engineering, A. P. Shah Institute of Technology, Thane, India*

***Abstract*: India is one of the fastest, emerging and developing country in the world. The development of the construction sector is rapid with the commencement of new construction technology. The primary aspects of construction management of any project are time, cost and quality; in addition to this the important factor of prefabricated technology includes construction waste reduction. However, in India conventional method takes more time and energy for planning and designing; whereas prefabrication is a new technology which is more convenient, environmental friendly and effective. Prefabrication is a modern approach of assembling components of structure in factory and transported assembly to construction site where the structure is to be erected. Prefabricated Construction (PFC) plays a significant role as it has the potential to cater the increased demand as well as to resolve the current problems in the construction industry like poor productivity, rising cost of materials, shortage of skilled labors and safety risks. Therefore, utilization is planned for prefabricated materials and components for master plan of proposed township at Ambivali in Kalyan taluka, Thane district of Maharashtra state. Difficulties may occur while application and execution- enhancing people attention towards adopting new techniques, difficulty in transportation of components, methods of installation and assembly, location of casting yard. Along with providing solution for difficulties faced, utilizing vacant area by planning and implementing prefabrication technology has to be done. Township will be proposed using proper guidelines and codal provisions given by town planning department and authority of prefabricated structures for hygienic, healthy and safe place for people.**

***Keywords*: Construction management, Difficulties in prefabrication, Prefabricated construction, Rural development, Town planning.**

1. Introduction

In the development of construction industry, prefabrication has made a big difference around the world in the last few decades. The word prefab is not an industry word like modular houses, manufactured houses, panelized houses or site-built houses. These are called as pre-engineered buildings. Prefabrication means a process of manufacturing or constructing structural components off site and then transporting all the assemblies or sub-assemblies to the construction site. Prefabrication can be done for the whole building or a particular component like prefabricated elements such as walls, floors, roofs, or interior of kitchen [1]. Prefab involves offsite fabrication of building components to be large to complete large scale building structures and systems, and their assembly on-site [8]. According to application and advertisement status of prefabricated buildings as compared to traditional buildings, the advantages of prefabricated buildings are obvious [2]. The benefits of prefabrication are reducing environmental impact of construction, less construction time, safety and security; improve quality, cost effective, and eco-friendly. Many of the benefits claimed from prefabrication also apply the use of modular building for high-growth, policy promotion and client leadership revealed to be the main driver [7]. The use of prefabrication technology has proven to be more feasible than usual due to various advances in design and construction technology such as computers-controlled fabrication equipment, 3D CAD, electronically controlled data and mechanization provides opportunities for improvement in design efficiency and coordination, combined with growth of emphasis of the industry to cover costs, schedules and highlight labor problems [4]. Due to fast delivery and convenience on site, prefabricated modular structures have a good ability to replace traditional construction methods at a fast rate [9]. Traditional methods include water, energy, materials and other environmental influences while prefab method has good environmental impact and many other benefits such as time and cost reduction, better quality, safety and less waste [6]. The calculated cost for buildings in the traditional method is Rs 1100-1500/- per sq. ft and for buildings in prefabricated method is Rs. 800-850/- per sq. ft [5]. As every activity has its own advantages likewise it also has disadvantages. The disadvantages of prefab are requires skilled labor, high initial cost, and leakage in joints. Prefabrication is known as offering more durable solutions for building, but developing countries are already dependent on local practices for design and construction that requires relatively short life cycle energy [3].

2. Scope

The scope of the study is limited to time, cost, and quality only, in the management of construction works. For the study of this project, we are going to select an area which is undeveloped. We searched some places like Kalyan, Dombivli and a place near Murbad, Pimpalgaon and at the end; we

*Corresponding author: aditidorugade@gmail.com

decided to select Ambivali near Kalyan. We particularly decided this place as the prefabricated structure will be limited to construction sites in urban areas like Mumbai as that area are already developed. For this Township we require a large land which is not possibly available in urban areas as there are very congested constructions. Another reason for selecting this site is the population. As all the commercial and residential buildings are located in urban areas, there is an imbalance of population over the region. So, to distribute these populations evenly we need to develop this rural area, so that people will divert themselves to these areas as well.

3. Objectives

To identify potential consequences arising from the ongoing use of prefabrication technology to reduce the construction waste, to minimize on-site construction, to reduce construction time and cost, to make more use of modern tools and mechanism instead of traditional or conventional construction techniques, to identify new technologies or methods in the construction industry this may require new training or skills of trades, to compare costs and durations of traditional building to prefab building by analysis, to reduce the use of bricks, rebars, cement, aggregate and excessive water, to build and construct a lightweight building and to make it earthquake resistant and resistant to adverse weather, to reduce waste and make it environment friendly.

4. Methodology

A. Site Selection

For the study of this project, we are going to select an area which is undeveloped. We searched some places like Kalyan, Dombivli and a place near Murbad, Pimpalgaon and at the end; we decided to select Ambivali near Kalyan as shown in Fig. 1. We particularly decided this place as the prefabricated structure will be limited to construction sites in urban areas like Mumbai as that area are already developed.

Fig. 1. Site selection

B. Master Plan

Fig. 2 master plan includes analysis, recommendations, and proposals for a site's population, economy, housing, transportation, community facilities, and land use. The master plan which we have drafted is located in Ambivali, Kalyan taluka. The area of this plan is 27 hectares, which faces the Kalu River with a varying distance of 200 m and behind there is a railway line at distance of 100 m which connects Kalyan and Titwala.

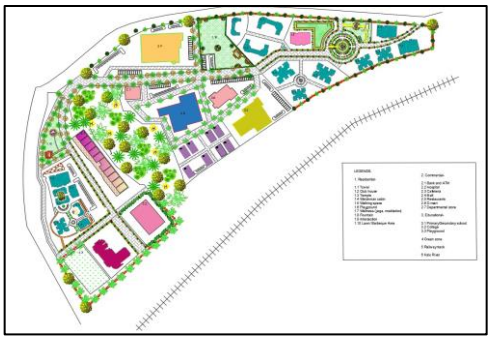

Fig. 2. Master plan

C. Planning of Structures

Structural planning involves a set of plans with details regarding the construction, installation, or reconstruction of any structure. Structures are planned in various zones as follows:

Residential Zone:

This master plan contains two residential zone namely Residential zone 1 and Residential zone 2 (R1 and R2).

Residential Zone 1:

Fig. 3, shows the zone contain main road of width 12 m and sub main road of width 7 m. There are 10 buildings which are divided into societies and one club house area. At mid there is a circular intersection with a temple placed in between and seating area, which diverts the road to different societies. Each building has 12 numbers of floors and a club house which has amenities like gym, mini theatre, indoor game rooms, yoga room, community hall, and library. At the backside of club hose there is a jogging and seating area.

Residential Zone 2:

Fig. 3, shows the zone contain main road of 12m and sub main road of width 7 m. There are 6 buildings and a club house which has amenities like gym, swimming pool, indoor game room, yoga room.

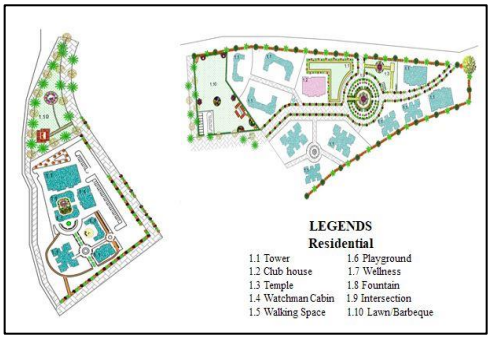

Fig. 3. Residential zone

Educational Zone:

We have provided a college and school with a combined playground as shown in Fig no. 04. The area occupied by school and college is 0.79Ha and 0.78Ha respectively. The school has nursery, primary and secondary sections, which includes amenities like classrooms, science laboratory, library, canteen, washrooms computer lab, kid's zone, auditorium, staff rooms,

principal cabin, and audio-visual room.

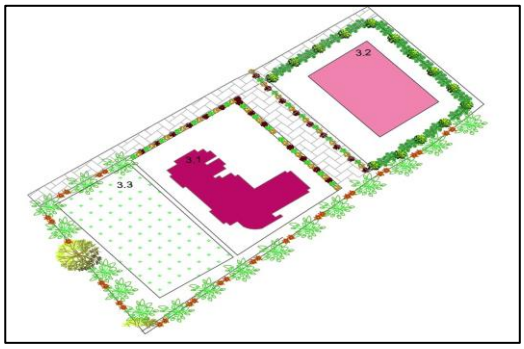

Fig. 4. Educational zone

The college has junior and senior segments including Arts, Commerce and Science department. Amenities like their respective laboratories and classrooms, library, study rooms, computer rooms, canteen, washrooms, enquiry office, staff rooms, principal cabin, storeroom, common rooms (Girls common room and Boys common room).

Commercial Zone:

In Fig. 5, we have provided a mall which occupies area up to 2.13Ha. The mall has a parking at basement and extra parking is provided in surrounding. The mall has amenities like shopping centers, cinemas, food court, car & bike showrooms, electronic showrooms, super market and game zone. There is lawn beside the mall and its area 0.96Ha. In the lawn we have provided gazebo and barbeque. Next there is a bank. The area occupied by the bank is 1.3 Ha. The amenities included in the bank are cash counter, manager's room, inquiry counter, passbook printing counter, waiting area, working area, storeroom, tiffin room, and washrooms.

Fig. 5. Commercial zone

D. Location of Yard

We have located on-site prefabrication plant opposite to the study area near Jarimari garden as shown in Fig no. 06. As this site is near to the construction site, the transportation cost is eventually reduced. We can use roads to transport the assemblies to the located site. As time is the main objective of the project, we can easily manage the time by reducing the transportation span.

Fig. 6. Location of yard

E. Technology for Manufacturing:

There are two ways in technology of manufacturing:

1. Plant preconstruction.
2. Site pre construction.

In this project, we have adopted site pre construction, as there were no any other factories available near to our site.

Site Pre construction:

When the process in which various prefab components are manufactured on site called site prefabrication. It does not require any transportation fees to carry the prefab member but does require lifting equipment to assemble the prefab components. Laboratory testing for various materials required for components and prefab components cannot be performed in site prefabrication.

F. Technology for Construction

By doing market survey and questionnaire survey; we have come to the conclusion that Waffle crete panel system is more convenient for slab and floor construction and Structural insulated panels are more efficient for construction other structural elements.

Waffle Crete Panels:

Wall, floor and roof panels can be cast while the building site is prepared. Waffle Crete molds are light weight and portable and useful for all kinds of projects. A typical mold can be used up to 500 times before needing repairs or replacements. With care, curing covers will last indefinitely. Waffle Crete molds can be shipped anywhere in the world by ocean containers and then trucked to their final destination. Local unskilled workers can be trained in hours. Waffle Crete molds is available in a range of standard sizes up to 10 meters.

Structural Insulated Panels:

This type of panel consists of two structural facings with a layer of insulating material sandwiched in-between. These are manufactured either by gluing the three pieces with strong adhesives or by letting the foam expand and cure while being formed in between the facings. In both processes, the facings are clamped together. Pressure and temperature are applied until the adhesive or foam has cured.

5. Conclusion

The conclusions which we get from this project are in various aspects like a prefabricated structure are reliable, sustainable, and, require less time for construction, assures good quality

products. Prefab allows flexibility as one can use for nearly all house design. The fully mechanized site pre constructional environment allows for much easier and greater quality control than a construction site does, and that can significantly reduce the need for correcting and redoing work on the project. The renowned ability of prefab materials to be re-used again and again, steel is the greenest building material out there. In fact, it is 100% recyclable. Steel does not give off toxic fumes during the construction process or in the event of a fire.

References

[1] Sanlong Man, "The Prefabricated Construction Project's Problems and Countermeasures of Construction Site Management", E3S Web of Conferences 261, 03020, 2021.

[2] Qiujin Ru, Jiandong Feng and Qin Lu, "Application and prospects of prefabricated buildings in rural area of China", ICMSE 2020, 2020.

[3] Nitesh J. Ramchandani, Hemant Salunkhe2019, "To study impact of prefabrication on profitability over traditional construction- A review", International Journal of Engineering Applied Sciences and Technology, Vol. 4, Issue 3, 2019.

[4] Shubham D. Auti, Jalindar R. Patil, "Prefabrication technology- A promising alternative in construction industry", International Journal of Science and Research.

[5] Palak Sachdev, "Modular construction and its adaptation in India", International Journal of Research in Engineering, Science and Management, Volume 1, Issue 10, 2018.

[6] M. Krishnanunny, Anoop K. K. 2018, "Prefab technology a solution to existing challenges in construction sector of India - A Kerala perspective", International Journal of Pure and Applied Mathematics, Volume 119, No. 15, 1339-1347, 2018.

[7] Wei Pan, Yi Yang and Lin Yan, "High rise modular building: 10-years journey and future development", 2018.

[8] Fred Edmond Boafo; Jin-Hee Kim and Jun-Tae Kim, "Performance of Modular Prefabricated Architecture: Case Study-Based Review and Future Pathways ", Zero Energy Buildings Laboratory, Graduate School of Energy Systems Engineering, Kongju National University, Cheonan, Chungnam 330-717, Korea, 2016.

[9] T. Gunawardena, P. Mendis and T. Ngo, L. Aye and J. Alfano, "Sustainable prefabricated modular buildings", The University of Melbourne, Victoria, Australia, 2014.