

# Pre-Fabrication Technology and its Application - Bhartiya Scenario

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**Abstract:** *The article considers temporary methods of using prefabrication technology in construction. The advance world experience in the construction of prefabricated modular building is analysed. It is emphasized that modular construction has potential to shorten project design and engineering time, reduce costs and improve construction productivity. The installation of prefabricated building is cost efficient, safe and eco-friendly. Modern Prefabricated system is based on using not only large elements such as "block rooms" but various small 3D building elements. The analysis results of Russian development in the construction of prefabricated building proof that Russia have great experience in the development of 3D reinforced concrete modules and prefab structures. As the research results the article shows promise for developing of Modern Prefabrication construction System in order to provide the population with affordable, comfortable and Eco- friendly housing. The project describes the prospects and relevance of introducing modular prefabricated units not only in low rise but into multistoried and high- rise construction as well..*

**Keywords:** prefabrication

## I. INTRODUCTION

Prefabricated construction is a new technique and is desirable for large scale housing programmes. Prefabrication has been widely regarded as an enduring construction method in terms of its impact on the protection of the environment. An important aspect of this perspective is the influence of prefabrication on the reduction of construction waste and subsequent waste management activities, including classification, reuse, recycling and waste disposal.

Prefabrication is a productive construction technique in terms of time, quality, cost, productivity, safety and functionality. The construction boom in India is developing at an accelerated rate of growth. It provides ample opportunity in India for a new entrant in the prefabricated sector.

Prefabrication is the practice of assembling components of a structure in a factory or other manufacturing site and transporting complete assemblies to the construction site where the structure is to be located. Prefabricated building is the completely assembled and erected building of which the structural parts consist of prefabricated individual units or assemblies using ordinary or controlled materials.

Today, prefabricated concrete buildings are the advanced construction techniques available around the world. Due to their wide applicability, prefabricated systems for buildings are becoming a popular choice for many 88constructions. Prefabricated concrete available in many shapes, sizes, including structural elements and non-reinforced parts.

The concept of prefabricated construction includes those buildings, where most structural components are standardized and produced in factories at a location away from the building, and then transported to the assembly site.

### Objective of study

The use of prefabrication technology in civil engineering has several key objectives, aimed at improving efficiency, quality, and sustainability in construction projects. These objectives include:

#### 1. Improved Construction Speed

- **Faster Project Completion:** Prefabrication allows off-site while site preparation is ongoing, significantly reducing overall project timelines.

- **Reduced On-Site Work:** Since components are manufactured in controlled environments, on-site assembly is quicker and less labor-intensive.

### **2. Enhanced Quality Control**

- **Controlled Manufacturing Environment:** Prefabrication takes place in factory settings, where conditions can be closely monitored, leading to higher-quality materials and components.
- **Standardization:** Components are produced to precise specifications, ensuring consistency and reducing errors.

### **3. Cost Efficiency**

- **Reduced Labor Costs:** Prefabrication minimizes the need for skilled labor on-site, lowering labor expenses.
- **Material Optimization:** Efficient use of materials in factory settings reduces waste and lowers material costs.

### **4. Sustainability and Environmental Benefits**

- **Reduced Waste:** Precise manufacturing processes generate less waste compared to traditional construction methods.

## **II. MATERIAL AND METHODOLOGY**

A number of new construction materials are starting to be used as components in prefab housing. Here are two of them:

- i. Structural Insulated Panels (SIPs)
- ii. Insulating Concrete Forms (ICFs).

### **STRUCTURAL INSULATED PANEL (SIP)**

A structural insulated panel (SIP, also called a sandwich panel) consists of a pair of oriented strand board (OSB) or plywood panels with a core of extruded polystyrene (EPS) foam in between, attached with an adhesive. Panels are available in a variety of thicknesses. They are usually produced in 8- ft-tall panels, but they can be customized as per the requirement. Its peculiarity is that the foam in the core is the best insulator and its thickness determine the value of insulation. The foam core forms a continuous energy barrier, and the smaller number of studs leaves less opportunity for heat conduction SIPs are fabricated to very close (1/8 inch) tolerances, and the edge connections, which vary by manufacturer, are designed to fit snugly together. The best thing about SIPs is their resistance to insects. Borate additives can be mixed into the foam during manufacture, providing some amount of insect resistance. De-lamination caused by failure of the adhesive is a major concern because it would affect the ability of structural SIPs to carry load.

### **INSULATING CONCRETE PANEL (ICFS)**

Insulating concrete forms (ICFs) are a prefab construction material which consist of hollow EPS foam blocks that are stacked and glued together on- site, creating a form that is filled with reinforcing bars and concrete. The unique property of ICFs is that the foam blocks are not removed after the concrete hardens; instead, they help insulate the building, while the concrete provides structural integrity. Although ICFs are really a hybrid prefab material, they offer many of the cost and environmental benefits of pure prefab. In comparison with traditional concrete construction, it is faster to stack ICF foam blocks than to build a wood form, and since the foam blocks are not removed, there is much less wastes. It can be also used as sound proof.

### **Application of Prefabricated Construction in Residential Construction**

CONSTRUCTION Prefabricated construction has a wide range of applications in residential construction, offering several advantages that make it a popular choice for various types of housing projects. Here are some key applications of prefabricated construction in residential building:

- 1) **Single-Family Homes:** Prefabricated construction is commonly used for single family homes. Entire homes or major components, such as wall panels, roof trusses, and floor systems, can be manufactured off-site and assembled on the homeowner's lot. This approach reduces construction time and can provide cost savings.

- 2) Multi-Story Apartments and Condominiums: Prefabrication is well-suited for multi-story residential buildings. Individual apartment units or modules can be manufactured in a factory and then stacked or connected on-site to create the larger structure. This approach is efficient and can help meet the housing demands of urban areas.
- 3) Affordable Housing: Prefabricated construction techniques are often used in affordable housing projects. The streamlined construction process and cost-efficiency make it a viable option for providing affordable housing solutions to communities with housing shortages.
- 4) Student Housing: Student dormitories and housing complexes can benefit from prefabricated construction. The repetition of identical or similar units makes prefabrication a practical choice, resulting in quicker project completion and cost control.
- 5) Senior Living Communities: For retirement communities or senior living facilities, prefabrication can be advantageous due to its ability to expedite construction schedules and ensure consistent quality in housing units.

#### **Advancements in Prefabrication Technology**

- 1) Building Information Modeling (BIM) and Digital
- 2) Robotics and Automation
- 3) Advanced Materials
- 4) Smart Prefabricated Materials
- 5) 3D printing technology

#### **Future Trends**

The future of advanced prefabrication technology is promising. Anticipated trends include the increased integration of artificial intelligence for enhanced project management, augmented reality for improved design and maintenance, and the utilization of the Internet of Things for real-time monitoring and data analysis.

- 1) Idea of Generating electricity Power By advanced roof top system in prefabricated building
- 2) Combining Wind turbines with Solar Panels

#### **Cost composition of construction project**

Housing construction cost is divided into construction engineering cost, building installation cost and building decoration cost. Construction project cost refers to the investment in the construction of housing. It is the foundation project, main structure, walls, doors and windows of the building part, the strong and weak electricity of hydropower projects, as well as the material and labor cost input such as water supply and drainage. Installation cost is the input to install the facilities and equipment of the house.

#### **Reason analysis of high prefabricated construction cost**

Through investigation and analysis, the code requirements of prefabricated construction engineering are higher, resulting in higher input level of resources and higher consumption. Therefore, the cost of building materials and precast concrete components is higher.

### **III. CONCLUSION**

In conclusion, prefabrication technology was becoming an integral part of the construction industry, offering solutions for faster, more efficient, and sustainable building practices. The industry was poised for growth, but continued success hinged on regulatory support, skill development, and ongoing advancements in technology and materials.

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