



# Implementation of Precast Technology in India: Prospects and Obstacles

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## ABSTRACT

Food, Clothing, and Shelter (In Hindi: Roti, Kapada aur Makaan) are the basic needs of every human being. Due to the economic slowdown and some governmental interventions in India, building projects are seeing significant time and cost overruns, ultimately impacting the end user. As these market pressures rise more and more, real estate developers are considering adopting emerging technologies to compensate for these construction issues. The Indian construction industry is undergoing a dramatic change from traditional methods of construction to modern methods of construction. Precast technology is one such move that is expected to enhance the productivity of the construction process, thereby, optimizing the requirement of resources on the site, reducing waste generation, and resulting in a faster delivery of the projects.

Keywords: Mass housing, Construction Management, Prefabricated construction, Challenges.

## 1. INTRODUCTION

A precast construction system is generally a large panel system, a modular system, or a combination of both. Pre-cast Large Construction Panel (PLCP) system consists of various precast elements such as walls, beams, slabs, columns, staircase, landing, and some customized elements that are standardized and designed for stability, durability, and structural integrity of the building. Precast residential building construction involves design, strategic yard planning, lifting, handling, and transportation of precast elements. This technology is suitable for the construction of high-rise buildings resisting seismic and wind-induced lateral loads along with gravity loads. The building framing is planned in such a way that the maximum number of repetitions of molds is obtained. These elements are cast in a controlled factory condition. The factory is developed at or near the site which provides an economical solution in terms of storage and transportation. Two main types of precast concrete elements, namely precast reinforced concrete elements and precast pre-stressed concrete elements are used as per the details given below: Precast concrete elements – Concrete components of a building prefabricated in precast yard or site and shall be installed in the building during construction. Precast pre-stressed concrete elements. These shall consist of pre-stressing tendons within the elements to provide a predetermined force needed to resist external loadings and cracks such as hollow core slabs, beams, and planks.

## 2. Methodology

### 2.1 Background and Current Scenario.

- **Past Scenario :**
  - **Limited Adoption:** Precast construction technology in India had been relatively slow to gain popularity compared to conventional construction methods. Traditional methods like cast-in-situ (on-site concrete pouring) were more commonly used due to familiarity and perceived lower costs.
  - **Infrastructure Projects:** The precast technology was mainly utilized in large-scale infrastructure projects such as bridges, flyovers, and metros. These projects offered the advantage of economies of scale, making precast more cost-effective.
  - **High-rise Buildings:** While precast construction technology was gaining traction in the construction of high-rise buildings, it was not as widely adopted as in some other countries.
  - **Limited Awareness:** There was a lack of awareness and understanding among developers, contractors, and engineers about the potential benefits of precast construction, hindering its wider adoption.
- **Current Scenario :**

- **Growing Adoption:** The use of precast construction technology has been steadily growing in India, especially in urban areas and major cities. Residential and Commercial Projects: Developers are realizing the benefits of faster construction and reduced labor requirements.
- **Advanced Technologies:** With advancements in precast manufacturing techniques and machinery, there has been an improvement in the quality and efficiency of the construction process.
- **Government Initiatives:** The Indian government has shown support for precast construction by promoting it in various infrastructure projects, and encouraging the use of modern construction techniques.
- **Addressing Housing Demand:** India's booming population and the need for affordable housing have prompted developers to explore innovative construction methods like precast to meet the rising demand.

## 2.2 Need for Precast Concrete Technology in India.

- **Rapid Urbanization:** India is experiencing rapid urbanization, leading to increased demand for construction projects. Precast technology can help in faster construction, enabling the timely completion of infrastructure projects and meeting the needs of the growing population.
- **Speed and Efficiency:** Precast components are manufactured off-site in controlled environments, reducing construction time significantly. This acceleration in construction speed is crucial for meeting tight project deadlines.
- **Cost-Effectiveness:** Although precast technology may require higher initial investments in manufacturing facilities, it offers long-term cost savings due to reduced labor costs, faster construction, and minimized wastage of materials.
- **Affordable Housing:** India faces a huge demand for affordable housing. Precast technology can play a vital role in providing cost-effective and quality housing solutions at a faster pace.
- **Modular Construction:** The modular nature of precast components allows for ease of assembly and disassembly, making it suitable for temporary structures, emergency shelters, and projects with changing requirements.
- **Challenging Site Conditions:** In areas with difficult site conditions or limited access to construction materials, precast components can be produced in centralized factories and transported to the site, overcoming logistical challenges.
- **Improved Safety:** Precast construction reduces the dependency on on-site labor, minimizing the risks associated with construction accidents. The assembly of precast components is often safer and more controlled than traditional construction methods.
- **Architectural Flexibility:** Precast technology offers a wide range of design possibilities and customization options. It allows architects and designers to explore innovative designs and shapes that might be challenging with traditional construction methods.
- **Long-Term Durability:** Precast concrete components are known for their durability and resistance to wear and tear, making them suitable for infrastructure projects that require long service lives.
- **Quality Control:** Precast manufacturing allows for precise control over the quality of concrete components. The controlled production environment ensures consistent quality and reduces the risk of defects, resulting in better-performing structures.
- **Resource Optimization:** Precast concrete technology optimizes the use of raw materials, reducing wastage and promoting sustainability in the construction industry.
- **Environmental Benefits:** Precast technology can significantly reduce the carbon footprint of construction projects. The controlled production process generates less waste, and the efficient transportation of precast components reduces the overall energy consumption.

As the construction industry continues to evolve and demands for sustainable and reliable construction methods increase, precast concrete technology is expected to play a crucial role in shaping India's infrastructure and buildings. Shortage of housing has been one of the most enduring problems faced by India. It is starkly evident by the fact that about 13.7 million households have been identified as living in slums by the census 2011 report. This problem has been growing exponentially with increasing urbanization. In urban areas, India faces a shortage of over 20 million houses at present. Reports indicate that by 2031, about 600 million people will live in cities, compared to 434 million in 2015. The union cabinet approved the Housing for All scheme by 2022 with a target to construct 20 million houses for the urban poor population to cater to the housing scarcity. The massive housing deficit, highlighted by the problem of affordability cannot be tackled through conventional technology utilized in the construction industry. Emerging technologies will play a vital role in the effective implementation of policies like Housing for All. Precast is one such emerging technology in India that can play a pivotal role.

## 2.3 Study of Latest Techniques in Precast Concrete Technology.

- **Hybrid Precast Systems:** Combining precast concrete with other construction materials, such as steel or glass-fiber reinforced polymers (GFRP), results in hybrid precast systems that offer enhanced structural efficiency and unique design possibilities.
- **Pre-stressed Precast Concrete:** Prestressed precast concrete components are designed to resist tension and prevent cracking. This technique increases the load-carrying capacity of the components and allows for longer spans in construction.

- **Digitalization and Automation:** The integration of digital technologies and automation in precast concrete manufacturing is improving efficiency and precision. Computer-controlled processes and robotics are being used to fabricate precast components with higher accuracy.
- **Prefabricated MEP (Mechanical, Electrical, Plumbing) Systems:** Integrating MEP systems within precast concrete elements before installation reduces on-site work and speeds up the construction process.
- **Insulated Precast Panels:** Precast concrete panels with integrated insulation provide improved thermal efficiency and energy performance in buildings.
- **Lightweight Concrete:** The use of lightweight aggregates, such as expanded clay, shale, or lightweight synthetic materials, reduces the overall weight of precast components, making transportation and handling easier.
- **Pre-finished Facades:** Pre-finished precast concrete facades come with a variety of surface finishes, including textures, colors, and patterns, which eliminates the need for additional finishes and reduces on-site work.

These latest techniques in precast concrete technology are enabling faster construction, better quality control, enhanced structural performance, and more sustainable building practices in India's construction industry. As technology continues to advance, precast concrete will likely continue to evolve and play a significant role in meeting the country's infrastructure and building needs. For the most current information on precast concrete technology in India, it is advisable to refer to up-to-date sources and industry publications.

#### *2.4 Study of Barriers to implementation of precast construction in India.*

The implementation of precast construction in India encounters various significant obstacles. One notable challenge is the lack of knowledge and education within the construction industry. Many professionals, including architects, engineers, and government authorities, may not fully grasp the benefits and techniques associated with precast construction. This knowledge gap emphasizes the necessity for specialized training programs to disseminate information and develop expertise. Furthermore, regulatory barriers present a substantial hindrance. Existing building codes and standards may not be well-suited for precast construction, resulting in uncertainties and reluctance to adopt these innovative methods. It is crucial to streamline approval processes specifically for precast projects to foster widespread acceptance. Another crucial aspect is the market dynamics; although precast construction offers long-term advantages, the initial setup costs for manufacturing units can be high, discouraging potential stakeholders. Moreover, concerns about market acceptance may make developers and clients hesitant to embrace precast construction. Lastly, challenges related to infrastructure and logistics, such as the transportation of large and heavy precast elements, further complicate the widespread adoption of this construction method in India. Overcoming these barriers necessitates a collaborative effort from industry stakeholders, policymakers, and educational institutions to promote awareness, streamline regulations, and demonstrate the long-term benefits of precast construction.

#### *2.5 Case Study*

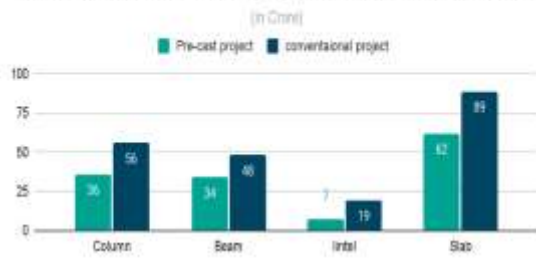
- CIDCO MASS HOUSING PROJECT USING PRE-CAST TECHNIQUE.

by B.G.SHIRKE CONSTRUCTION TECHNOLOGY PRIVATE LIMITED

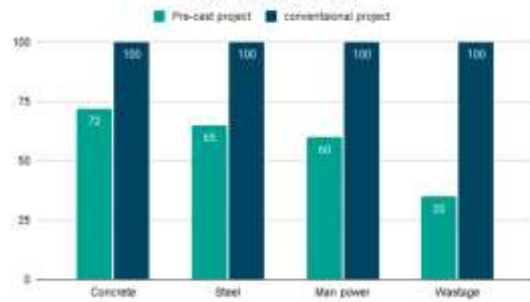
In NAVI MUMBAI, under Pradhan Mantri Awas Yojana (PMAY), The City and Industrial Development Corporation of Maharashtra (CIDCO) has already initiated the construction of residential buildings. It is approved by Maharashtra RERA and built to cover LIG and EWS housing units with all modern amenities. The location of the project is Talaja, spanning 21.32 Acres with 64 towers, the project offers 4194 housing units.



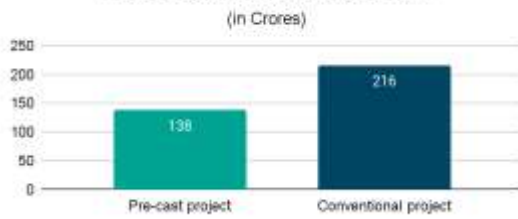
**Cost comparison between Precast and Conventional system**



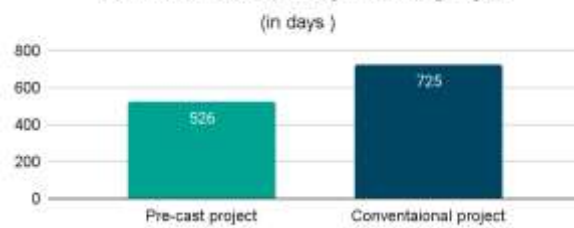
**Benefits of Precast**



**Total cost comparison graph**



**Total Duration comparison graph**



**Time comparison between precast and conventional systems**



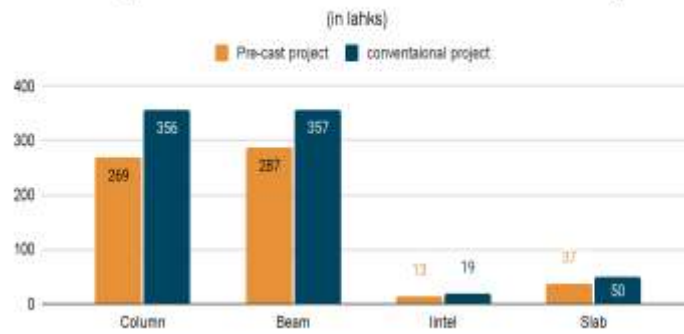
• **Sobha Dream Acres Apartments USING PRE-CAST TECHNIQUE.**

by Sobha Construction Company

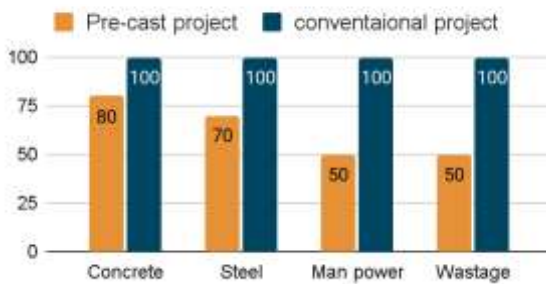
The well-known real estate developer Sobha has brought an amazing and affordable residential project named Dream Acres. The vast project will be spread over an area of 81 acres making it a highly spacious project in the area. The project will consist of a total of 6500 units of 1 BHK and 2 BHK (Large) Segment Houses. Precast technology and other high-end construction techniques are used in the construction.



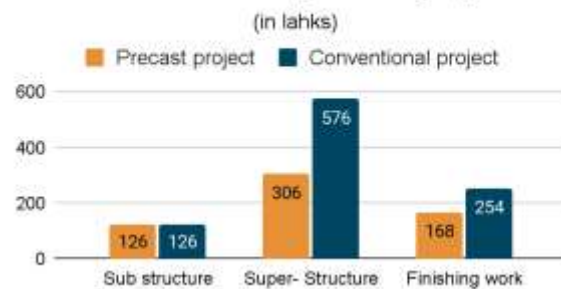
### Cost comparison between Precast and Conventional system



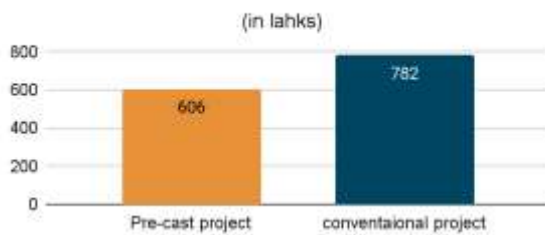
### Benefits of Precast



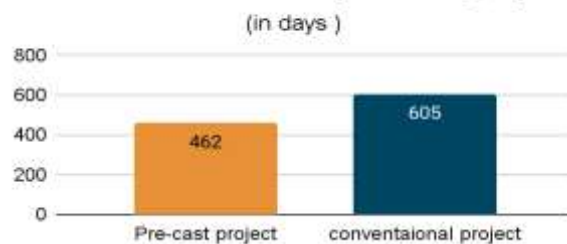
### Total cost comparison graph



### Total cost comparison graph



### Total Duration comparison graph



### 3. Conclusion.

India and most other developing countries are witnessing significant Urbanization-Migration. Because of this, most of the developing countries are facing a huge housing shortage. Cast-In-Site (CIC) construction is not adequate to meet the current and future housing demands. Precast Concrete Construction (PCC) is a feasible technology that can be adapted to provide affordable mass housing and reduce the housing shortage. This study identified various factors hindering the growth of the PCC industry in India. It was found that various stakeholders have different opinions and there exists no consensus among them on the factors hindering the growth of PCC in India. However, the major factors seem to be the negative perception of the PCC technology, lack of qualified engineers and experts, reluctance of architects to adopt PCC, inappropriate taxation measures, lack of standards and codes, lack of mega projects for PCC, and schemes to meet the housing demands, the housing shortage is still very significant – making it necessary to implement PCC for all such projects. Finally, a set of measures, in five key areas, is suggested to promote the growth of PCC to reduce the housing shortage in India.

Precast technology shall be a game changer for the Indian construction sector.

To decide if construction is a decent choice you have to consider.

- Proper cost analysis and planning can help to achieve an economical estimate for prefabrication. Educating students, trainers, and even laborers more about prefabrication in depth will help provide a more trained and educated workforce for prefabrication.
- It can also change the conventional mindset of people and allow them to try modern construction methods. The use of standardized elements from companies that have a variety of options to choose from can help make the structure unique.
- One-time investment in good quality lifting machines and proper maintenance can help in further savings.

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