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# Benefits and Challenges of Precast Construction in India – A Review

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**ABSTRACT**

*Most of the construction activities in India take place by the conventional cast in situ method of construction. But still, there is a huge demand for housing in India. So the construction activity has to take place in a much faster way. This cannot be achieved by the conventional method of construction. It can be done possible with precast concrete construction. Moreover, there are more advantages of precast concrete construction over conventional one. So various kinds of literature are studied and reviewed, some of those have been given in this paper. Precast engineering's unique approach to construction brings a new facet to civil engineering as well as contributes opportunities to the transportation sector of the country. Undoubtedly it is one of the most beneficial techniques in construction and hopefully shall become a leader in the development of housing and metropolitans of our country. The following study analyses different aspects including precast construction materials, designing, and calculations as well as economic advantages and limitation of precast construction engineering*

**Keywords: -** *Prefabrication, Precast, conventional, Construction management*

## INTRODUCTION

The concept of precast (also known as "prefabricated") construction includes those buildings, where the majority of structural components are standardized and produced in plants in a location away from the building, and then transported to the site for assembly. These components are manufactured by industrial methods based on mass production to build a large number of buildings in a short time at a low cost. The precast concrete industry is largely dominated by Government initiated projects for infrastructural development. However, these are also being extensively used for residential (low and high rise) and commercial constructions because of their various favorable attributes. The efficiency, durability, ease, cost-effectiveness, and sustainable properties of these products have brought a revolutionary shift in the time consumed in the construction of any structure. The construction industry is a huge energy-consuming industry, and precast concrete products are and will continue to be more energy-efficient than their counterparts. The wide range of designs, colors, and structural options that these products provide is also making it a favorable choice for its consumers. Precast concrete is a construction product produced by casting concrete in a reusable mold or "form" which is then cured in a controlled environment, transported to the construction site, and lifted into place. Many state and federal transportation projects in the United States require precast concrete suppliers to be certified by either the Architectural Precast Association (APA), National Precast Concrete Association (NPCA), or Precast Prestressed Concrete Institute (PCI). Materials used for precast concrete structures are concrete, steel reinforcement, structural steel & bolts, and Non-cementitious material (Elastomeric bearings for Neoprene, rubbers & mastics are used for soft bearings pads, backing strips, etc). If one sees from the beginning, **Dr. Jacqueline Glass (1994)** found that in the historical background of precast concrete, mainly of European countries, different features like fire resistance, thermal mass, durability, acoustic insulation of precast concrete on building got discussed. There are many different types of precast concrete forming systems for architectural applications, differing in size, function, and cost. In 2002, **M S Palanichamy** et al, the maximum carpet area for the same plinth area is achieved by the use of lesser thickness of wall panels**.** By 2012(**Ng Ban Kiong, Zainal Abidin Akasah)** it was finally found that a common problem was the connection between the beam to column and column to base due to poor connection. **Bindurani, P, A. Meher Prasad et al.,( 2013)**observed that the model, which was not considering any shear transfer through the vertical joints, tends to provide conservative results in terms of the amount of steel requirement. The emulative monolithic wall system seems to be adequate in moderate seismic zones. **Rinkesh Patel et al.,** The prefabrication is lightweight and has a

thermal insulation property, easy workability, and economy in cost, easy availability. **Prof. U.J Phatak et al.,(April 2014)** the study of problems which are rising during the pre-cast construction and remedies to overcome those problems to increase productivity and also indirectly the economy of India. So that it can be used in large amounts for the increase in the speed or to cut down the construction time. Although **O. Ottevaere** (2014) said that Overall Precast construction will minimize the time and cost of construction, **Dinesh Kumar et al,(2015),** found the prefab construction for individual double story residential building cost is 13% more than the conventional construction. Precast architectural panels are also used to clad all or part of building facades or free-standing walls used for landscaping, soundproofing, and security walls, and some can be prestressed concrete structural elements. Stormwater drainage, water, and sewage pipes, and tunnels make use of precast concrete units. Using a precast concrete system offers many potential advantages over onsite casting. As for time affectivity, **Siva Priya et al.,(may 2016)** found the precast method of construction can increase productivity and quality of work through the use of better construction machinery, equipment, materials, and extensive pre-project planning. Finally, **Lakhi M. Chavan et al.,(Aug -2017)**, says that the impact of the site on the local environment is for a shorter period, using prefabricated building components in building construction projects can reduce the curing times from the critical path of the project and eliminating the need for temporary formwork. Precast concrete production is performed on the ground level, which helps with safety throughout a project. There is greater control over material quality and workmanship in a precast plant compared to a construction site. The forms used in a precast plant can be reused hundreds to thousands of times before they have to be replaced, often making it cheaper than onsite casting when looking at the cost per unit of formwork. The main features of this construction process are as follows:

- The division and specialization of the human workforce.
- The use of tools, machinery, and other equipment, usually automated, in the production of standard, interchangeable parts, and products.
- Compared to site-cast concrete, the precast concrete erection is faster and less affected by adverse weather conditions.
- Plant casting allows increased efficiency, high-quality control, and greater control on finishes.

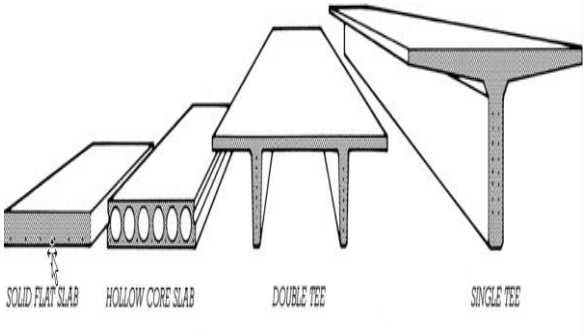


**Fig.1: Precast Slabs**

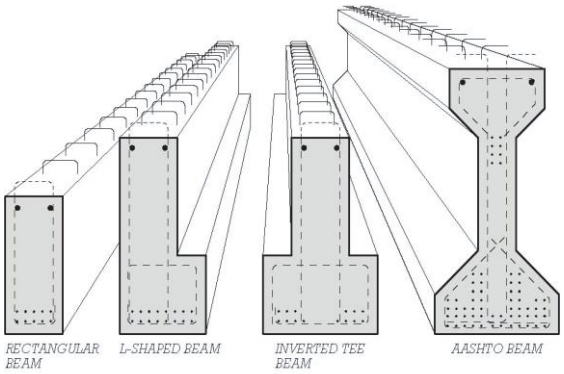


**Fig.2: Precast Beam & Girders**

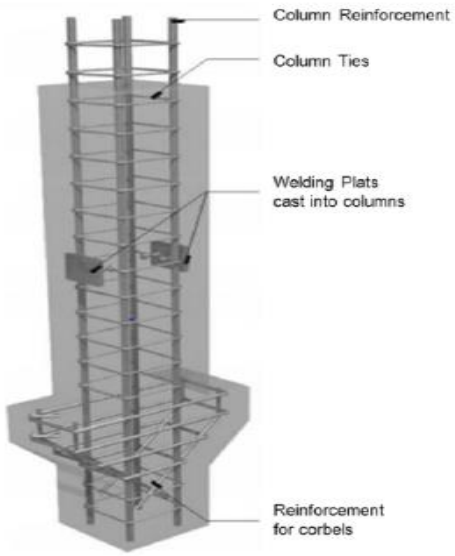


**Fig.3: Precast Column**

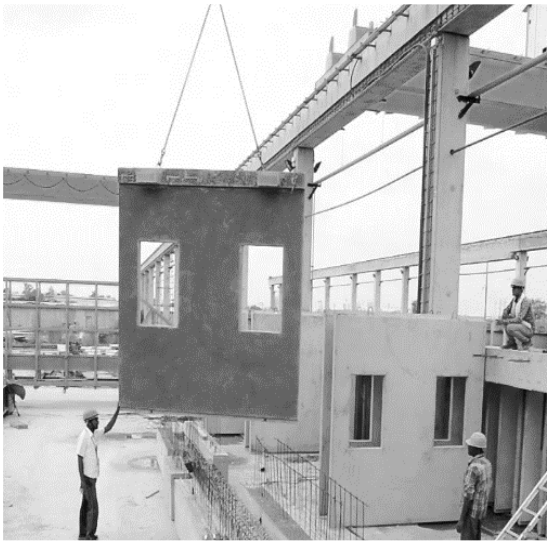

**Fig.4: Precast Wall**

This type of construction requires a restructuring of the entire conventional construction process to enable interaction between the design phase and production planning to improve and speed up construction.

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## BENEFITS

The use of precast concrete may have many advantages over regular methods of construction. After reviewing the literature stated above, the following benefits were found:

1. The main advantage of the prefabricated method is the celerity by which the construction process takes place. Rapid urbanization, a tremendous shortage of skilled labor, and the need for having hassle-free construction methods is a trigger to offer prefab technology to build homes faster.
2. Another great advantage of prefabrication is durability. These prefab houses show better performance as they undergo a strict checking mechanism that ensures the product comes out to be defect-proof.
3. These types of houses can be customized to specific needs/demands/requirements thus making it ideal than residing in conventional slums. These specific needs may include fire/ water/ soundproofing.
4. Lesser waste is generated due to planned construction.
5. Process unaffected by adverse climatic conditions such as rainfall, snowfall, and heat.
6. Requires less labor as compared to traditional forms.
7. Utilization of cheap labor forces away from the construction site.
8. Greater project certainty.
9. Safer working environment
10. Reduced air and noise pollution at the construction site, especially useful when the site is situated near densely populated cities.

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## CHALLENGES

India is experiencing a huge housing crisis today. The current housing shortage estimates to about six crore units. While many developing countries are struggling with the housing crisis, many developed countries have tamed this problem with precast concrete technology. Precast concrete construction technology is one of the promising solutions to meet the huge housing demand. The use of precast concrete systems offers several advantages such as fast and quality construction and enhanced health and safety. Despite these advantages, the industry has not gained popularity in India. To identify the major current challenges faced by the precast construction industry, a round table discussion among various stakeholders was held at IIT Madras. The article summarizes the proceedings of the meeting and brings out the critical issues associated with the precast concrete industry in India. The findings indicate that the lack of standardization, certification and testing facilities, contractual issues and taxation, non-availability of tools, technology, and equipment, limited knowledge, and lack of government incentives and promotion are some of the major challenges faced by the precast concrete construction industry. The article also discusses an action plan to alleviate the current precast concrete construction scenario.

Housing types in India vary significantly and can reflect the varying socio-economic mix of its vast population. The housing sector is the second largest employment generator and contributes about six percent of India's gross domestic product (GDP). The sector with 250 ancillary industries, has the potential to generate significant employment opportunities. (KPMG, 2014) However, several structural issues such as high fees, taxes, and limited and expensive capital have restricted the desired growth concerning housing demand. As per studies conducted by the Ministry of Rural Development and the Ministry of Housing and Urban Poverty Alleviation, it is estimated that almost a quarter of Indian households lack adequate housing facilities. The central and several state governments in the past have undertaken various steps to mitigate the urban housing deficit (Rajasthan affordable housing PPP model, Delhi Development Authority Land pooling policy). These efforts have yielded notable results. While efforts taken in the past are commendable, they have to be accelerated to eliminate the housing deficit. Acknowledging the importance of the housing issue in the country, the Central Government has launched a massive campaign (Housing for All) in June 2015 which promises to provide housing to all its citizens by the year 2022. According to the Report of the

Technical Group on Urban Housing Shortage (2012-2017) (Ministry of Housing and Urban Poverty Alleviation), Rural Housing for XII Five Year Plan (2012-2017) (Ministry of Rural Development, Government of India, 2011) and KPMG analysis in India (KPMG, 2014), the development of this ambitious program requires about 11 crore houses by 2022 with investments of over USD 2 trillion.1 The urban housing accounts for about 85-90 percent of the total investments and the affordable housing requirement is about 70 percent of total investments. To meet this huge urban housing demand, the precast concrete construction industry can play a crucial role. In a developing country like India, it is necessary to fulfill the present need of the infrastructure. Government investing a large amount about 40-50% of the total budget. While constructing the various buildings that may be commercial, residential, or any other building for achieving the fast and desired quality pre-cast concrete/construction technology is used nowadays in India. And this technology is at an initial stage i.e. it cannot be used as a primary technology in India because it has some problems. Which are arising during the pre-engineering work, staking of the members, transporting, and erection and at various construction stages, etc.

## CONCLUSIONS

The precast construction technology offers advantages such as 1) cost-saving, 2) Time savings, 3) Quality enhancement 4) Less labor required, 5) Enhanced safety 6) Reduced wastage. But the implementation of Precast technology in the Indian construction industry has some challenges as discussed in the results above. The proper measures should be adopted to promote precast technology in India. . The government should take initiative in this regard. Despite having the advantages mentioned above companies are not following the technique as several precast concrete elements manufacturing units or industries are very few in India, so dependability on the supply of precast elements is very high and they find it very risky. The setup of a precast yard requires a very high initial investment, so in India, investors should promote this technology. Precast engineering although has certain criteria for its execution that include proper roads and transportations to carry the constructions from the factory to the site without any damage or hazard. Precast engineering as an ideal mode of construction for energy efficiency and sustaining resources requires skilled groups of labor in adequate numbers to handle and monitor the execution of the precast constructions. One may conclude that precast engineering adds to economic development via its criteria by providing development and employment opportunities to India's economy. In today's world country's like the U.S, China, and Australia, etc, have successfully adopted the precast construction technique whereas India being a developing country has failed to render be the benefit of precast construction due to its transformational and geographical hardships. However, one cannot be neglect the advantages of a pollution-free and hazard avoidance environment offered by the precast construction. Therefore if the near future looks forward to the development of precast construction in the housings sector of the country, the benefits will prove to be a boon for Indian civil engineering.

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