



## A Review On Comparative Analysis Of Precast Construction Technique

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**Abstract** – In the last few decades, the use of precast concrete structural systems has progressed dramatically all over the world. Precast concrete is now widely used in both residential and commercial construction projects. It is due to the precast concrete's property. This is because in terms of speed, durability, modularity, quality control, efficiency, automation, aesthetics, affordability, accuracy, optimization, and low maintenance, precast technology outperforms conventional framed construction. Precast concrete is a cost-effective, safe approach to construct any form of structure. It ensures a quick build time, great profit margins, and good quality. So, several literatures have been examined, and a review of all of them has been provided in this paper.

**Keywords:** Precast, concrete, construction, review, components, structure.

### 1. INTRODUCTION

Concrete is precast by pouring it into a reusable container mould or "form," curing it in a controlled environment before being transported to the job site and lifted into place. Exterior and interior walls are both made of precast concrete. Precast concrete is given the opportunity to cure properly and be continuously monitored by plant staff by being manufactured in a controlled environment. When compared to onsite casting, using a precast concrete technique has a lot of benefits. The production of precast concrete can be done on the ground level, which improves project safety. In comparison to a construction site, a precast plant has greater control over material quality and workmanship.

#### 1.1 Structural parts made of precast concrete

The different precast elements necessary in the building construction are assembled and connected to create a precast building. The following are the components:

- Precast walls
- Precast slabs

- Precast beams
- Precast columns
- Precast foundation

#### 1.2 Precast construction systems are divided into several categories.

Precast systems are classified into the following groups based on the load-bearing structure:

- Slab-column systems with walls
- Frame systems
- Large-panel systems
- Mixed system

#### 1.3 Precast concrete Applications

Sandwich wall panels made of precast concrete have been utilized in schools, business buildings, apartment complexes, townhouses, condominiums, hotels, motels, dorms, and single-family homes, to name a few. Although they are often thought of as part of a building's enclosure or "envelope," they can also be built to act as part of the structural system, obviating Beams and columns are required around the perimeter. They provide exceptional noise absorption, outstanding durability, and speedy construction, in addition to their energy economy and aesthetic adaptability. Sandwich panels, in addition to having superior insulating capabilities, require fewer labour steps to complete. Sandwich panels, on the other hand, require far less labour and scaffolding than double-walls, which must be on-site insulation and concrete filling are required.

#### 1.4 Precast construction advantages

Precasting is ideal for mass production of identical components in huge quantities. For example, when constructing a project for cheap homes with similar units, precasting may be used to create wall and floor slabs for all of the flats, which could then be lifted into place and connected.

- It makes building easier when carried out in a plant or yard dedicated for the following reasons:
- The work is carried out instead of in the height, on the ground. It's possible to accomplish it in a climate-

controlled structure, which eliminates issues like as rain, dust, cold, and heat.

- For several repetitions of the same component, specialised formwork can be developed.
- The liquid concrete may be made, moved, and poured using specialised equipment.
- Curing is done in a sterile atmosphere.

Construction can be completed quickly because the components can be made ahead of time. Engineers must create each set of components following the preceding set has been completed in cast-in-situ construction, which takes time because concrete takes around 28 days to attain full strength.

## 1.5 Precast construction disadvantages

Precast concrete construction has a few significant drawbacks:

- The structural frame or system, unlike ordinary concrete construction, is not monolithic or continuous because each piece is built separately. Structural discontinuity is caused by the joints between the parts. Because the building's forces will be transmitted through these joints, they must be constructed to do so safely and effectively. It's worth noting that non-structural parts can also be made of precast concrete.
- The seams between neighbouring members must be sealed with particular sealants to make them waterproof because the building is made up of independent components.
- The majority of precast components are huge and hefty. This necessitates the use of cranes to lift them into place, and these cranes must function across the whole volume of the building. Because there will only be a few cranes on site, the time it takes for the cranes to pick up a piece and move it to its final location is crucial in deciding the construction timetable.

## 2. LITERATURE REVIEW

**2.1 Kumar A,et.al. (2020)** Studied challenges and benefits of using the precast construction in India. In the process, they analyzed various aspects, including the design and calculation of prefabricated building materials, as well as the economics and limitations of prefabricated design. In it they discussed that the developing country like India government should take initiative in this regard because a large amount of investment is required and it cannot be used as a primary technology in India because it has some problems. Despite the advantages of cost saving, time saving, quality improvement, labor reduction, safety improvement, waste reduction, etc., companies do not apply this technology because there are few precast concrete manufacturing units or industries in India, so the reliability of supply of precast Concrete has a very high content and they found it very dangerous. The United States, China and Australia have successfully adopted prefab construction methods, while less developed countries in India have been unable to utilize prefab construction due to technical and economic factors and difficult geographical conditions.

**2.2 Tia X,et.al. (2020)** Mapped of value stream is used as a learned methodology to analyze and compared the process difference. Relationship between Canadian prefab projects and

Chinese prefab projects as a basis for improved process waste reduction. The results of this study show that projects in Canada have less rework, shorter lead times, higher productivity, and a higher proportion of standardized prefabricated designs. On the other hand, the project in China had higher quality of shop.

**2.3 Yadav D,et.al. (2019)** Analyzed implementation of precast concrete technology in large size construction project. They discussed how the precast technologies is not only helping contractors and builder get their building faster and more economically they analyzed background and present scenario that how precast play an important role in modern world construction. The world has yet to find its rightful place in Indian architecture, regardless of its incredible benefits of speed, quality and economy in development, it has yet to strike deals with architects, builders and government agencies. A cost analysis model of Indian building prefabrication technology compared to conventional technology was developed. The cost model emphasizes that substructure costs are the same for conventional and prefabricated buildings. They conducted a live prefab design case study. The case study aims to share practical experience and raise awareness of the potential of prefabricated elements.

**2.4 Ray D,et.al. (2019)** Aimed on evaluation of precast concrete pavement system. To find the design methods which are used in transport infrastructure and better understanding of the current systems is the main objective to review on precast concrete pavement (PCP) systems. This paper includes the advantages and disadvantages of the precast concrete pavement system along with the method of construction. These days we face many problems due to due to conventional cast-in plane concrete pavements like Long-term traffic restrictions it also has low production cost, long term durability, low maintenance requirements etc. This research includes new precast concrete pavement (PCP) system.

**2.5 Rajasekaran C,et.al. (2018)** Studied challenges facing by the precast technology in India find whether to use a prefabrication adjacent to site or prefabrication in a factory, and three factor in any construction which are Quality time and time cost different between onsite and offsite prefabrication. A survey was also done to find out which is better option between prefabrication adjacent to site and prefabrication in a factory to go for Many factor considered in the survey which are Number of supplies, Location of suppliers, Labour cost, Production rate, Robustness, quality of finishing, Quality control, Safety, Stacking of product 1 Rok in return investment, ease of handling equipment flexibility a in structured design, Adaptability of resources, Waste reduction, Weather cost comparison between prefabrication adjacent to site and prefabrication in a factory is done it will vary with scope of the precast work and distance at which site located from the precast manufacturing factory. Time comparison is also done between too both them which compare which one is takes less - total construction time.

**2.6 Tachyon K,et.al. (2017)** Researched about the comparison of traditional slab system and half precast Concrete slab system on Construction Productivity. HPCSS is reported to exhibit excellent structural performance when compared with traditional slab systems. The research looked at detailed data from construction projects that employed HPCSS and CIPSS at same time for used of two discrete event simulation and multivariate data analysis techniques for this. However, there is a lack of extent research examine the construction issues of an HPCSS The simulation result indicates that the work productivity of HPCSS is 1.7 times that of CIPSS and the cost per productivity unit. Of

HPCSS exceeds that of a traditional slab system. In the results of the study, it can be used to develop an optimal construction plan for a construction site in which HPCSS is installed and that HPCSS can be increased applied in the future.

**2.7 Singh R,et.al. (2017)** Studied the precast technology and its history, type of precast system and its advantages over Conventional construction. Cost factor in which it is found that the cost of construction with precast technology is higher than the conventional method but in practical it works out to the same value and get much superior product on the same amount of investment precast concrete building in which specific design philosophy of precast structure involves stabilizing systems. It is concluded that the precast technology is better the conventional and use of precast concrete will enhance in the future of construction.

**2.8 Venkateswarlu D,et.al. (2016)** Studied a thesis on the design, cast and time analysis of Precast and RCC building. Major factors which are cast and duration and minor factors are speed of construction, quality control, environmental conditions Labour resources, durability, connection, size, shape are also considered for the analysis. Design and case study for same building as a Traditional Cast in-situ building and as a precast building is done. Form analysis of the building in case of precast building cost is reduces and duration of construction is much lesser than the traditional method. The result showed that precast system is economical then the traditional method.

**2.9 Yadav L,et.al. (2015)** Studied deals with the use and the application of precast concrete for various types of buildings. It also described the seismic-strengthening techniques, earthquake performances of precast buildings, and benefits of using precast elements in building construction. In the last few decades. The application of precast concrete structural systems has been attaining vast progress worldwide. Compared to monolithic systems precast structural systems possess several advantages such as quality control, speedy construction, and suitable application to regularly modular systems.

**2.10 Riyanto R,et.al. (2014)** Research, development and application of prefabricated system buildings using this concept of non-connected prestressing and local energy dissipation device connections were carried out in Indonesia in 2013-2014, using alternatives that are sustainable during the life cycle of the building, namely Seismic prefabrication system used. This subject is equivalent but more effective than the isolation concept developed by the American Precast Seismic Structural System (PRESS). This connection uses an infinite post-tensioning system and interchangeable dissipator units. After earthquake excitation, when the seismic design load is exceeded, the energy dissipater acts as a replaceable fuse, and the infinite post-stress action restores the structural deformation to its original position. Since 2002, the term has been included in ACI 318 code NZS 3101:2006 and Indonesian standard SNI 7833-2012.

**2.11 Chew H,et.al. (2014)** Research work on connection behavior of precast walls under shear stress. Investigate the connection between the exterior and interior walls made of precast concrete. Compared to cast-in-place concrete, precast concrete offers the advantages of more sustainable construction, improved quality control, and lower costs. The purpose is to

determine the behavior of the ring-rod connection under lateral loads. The connection showed few wire cracks and a lot of flexing to strongly indicate a fault. The ductility is at the acceptable limit of the structure. The building industry was told that this connection design could be used for prefabricated buildings of medium height.

**2.12 Kong B,et.al. (2012)** Studied the precast concrete system for building maintenance. The Used precast concrete system for building its factor that will lead to maintenance issues are analyzed and factors need to be considered at the design, manufacturing and construction stages of precast concrete system. Found that the factors which lead to poor consideration of building maintenance. It is concluded that the proper planning should be available if not it may lead to building maintenance issue.

**2.13 Bidwai V,et.al. (2011)** Studied help in understanding the development and improvement in seismic resistant concrete construction, in these papers they analysis seismic performance and design of precast concrete building structure and to find ways to improve and develop construction of precast concrete structure. They studied the historical perspective on the performance of precast concrete structures and extensive literature on experimental studied show how precast concrete systems perform better in earthquakes. Provisions of American, New Zealand and Euro Codes and guidelines related to the seismic performance of precast concrete systems are discussed in these papers to practices is presented to help in develop the provisions and practice of these systems in Indian perspective spotting of area the need attention in the present Is code provisions studying the codes and comparing with other international for reconsideration or revision to achieve the good performance in seismic zones.

**2.14 Hammad S,et.al. (2009)** Contemplated are on usefulness improvement of precast substantial development. The creation interaction is examined utilizing the creation postpone model in this investigation forty cycle information is utilized the near effect and seriousness are estimated for five deferrals caused: Environmental, work, and the board, hardware and material on the framework usefulness. In it the creation postpone investigation that material, trailed by gear then, at that point, work was significant supporters of framework delay are established. Factual examination on the establishment process duration of three pre-projected part cycle types is done, to guarantee the defer saw in the initial step is credited to variety of precast pieces. In the end it is presume that the future work is to create. Choice model that could be involved by creation and development directors to further develop plant and on location creation.

**2.15 Poon Cet.al. (2007)** Experimented conventional cast in-situ construction involving wet trades and on-site construction procedures are used extensively. The Hong Kong construction industry heavily relies on conventional cast in-situ construction. Prefabrication has increased in the building industry in recent times. This presents the preliminary findings of an ongoing the employment of prefabrication processes in Hong Kong has evolved through time, according to a study. The issue investigated where the impact of the use of prefabrication on important issues such as labour requirements, cost, time, on-site safety, labour requirements etc. While using prefabricated it was found that the construction cost was slightly higher than conventional construction but the quality of construction,

construction time reduction and on-site environment performance were improved by using precast construction.

### 3. CONCLUSIONS

It has been discovered, based on an analysis of several literatures, that

- Precast concrete is used all over the world and has a variety of qualities, including the ability to withstand seismic and cyclic loads.
- With a higher ratio of standardized precast design, precast has less rework, shorter lead times, and increased productivity.
- The Indian precast sector faces issues such as a shortage of tools, equipment, and knowledge, as well as a lack of standardization, certification, and testing.
- The cost of precast varies depending on the extent of the project and the distance between the job site and the precast manufacturing factory.
- It has a high level of quality control.
- Precast construction helps speed up the construction process.
- Precast building necessitates a very small amount of effort.
- Precast structure is also incredibly simple to assemble and connect.
- Even though precast building has numerous advantages, it remains unresponsive in nations such as India. They still prefer traditional building, which they regard to be safe because precast is slightly more expensive than traditional construction.
- It could also be a result of our country's lack of understanding of precast.

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