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Implementation of Precast Technology in IndiaÙ Opportunities and Challenges

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Abstract

Rapid economic growth and limited availability of affordable land have restricted the horizontal mode of construction leading to vertical construction in most of the Indian cities. Urban India is mostly marked by tall buildings that are being built. Due to the economic slowdown and some governmental interventions, these building projects are seeing significant time and cost overrun, ultimately impacting the end-user. As these market pressures rise more and more, real estate developers are considering to adopt emerging technologies to compensate for these construction issues. Indian construction industry is undergoing a paradigm shift from traditional methods of construction to modern methods of construction. Precast technology is one such move which 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. While internationally precast technology is considered as a mature technology, in India, it is not widely utilized, despite the advantages. Commonly cited constraints are high costs in comparison to traditional construction, economies of scale, logistics, skill level required, end user friendliness, etc. Primarily, this study focusses on identifying the challenges faced by the precast technology under various categories. This study also presents a cost analysis model for precast technology versus traditional construction to address some of the challenges. Presented cost model is applied to two projects wherein precast technology and conventional technology are utilized to construct the project and an inference is drawn comparing the time and cost aspects of precast technology. Amicable solutions are proposed for adoption of precast construction from an Indian perspective.

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1. Introduction

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 of households have been identified as living in slums by the census 2011 report [1]. 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 [2].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 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 effective implementation of policies like Housing for All [3]. Precast is one such emerging technology in India that can play a pivotal role. The precast technology involves the manufacturing of different components of construction in a controlled environment such as factory and delivering them to site for erection and assembly [4]. For a building, the precast components can include elements such as columns and beams, floor slabs, in-filled walls, bathrooms, and staircases, etc. These building components are manufactured under a controlled environment in a specific factory setting and subsequently transported and installed at the project site. Precast elements can be manufactured at offsite as well as onsite.

Use of precast technology in construction has numerous advantages. As the precast elements are produced in a factory, better quality of concrete can be achieved because of the controlled environment. Precast mode of construction has a lesser dependency on labor force compared to conventional technique which helps in minimizing the disarray in coordination, scheduling, and sequencing of the project. There is no need for curing on site after assembly of members because the members are cured in a factory for the desired duration. The cost of the formwork is eliminated by using precast which can result in savings. Cost to carry out post concrete repairs can be eliminated by using precast members. Precast also enhances occupational health and safety as minimum operational risks are involved. Its use can lead to significant wastage reduction at the site [5] because on-site construction activities are minimized. Through effective planning and design, material quantity required for doing the same construction can be reduced by using precast technology [4]. This can be compounded by the fact that it helps in waste reduction making precast a more sustainable and environment-friendly technology for construction. The biggest advantage of precast is that it accelerates the construction process thereby reducing the duration of the project [6].

Despite the well-documented benefits, the use of precast concrete in Indian construction sector is limited. One of the major reason for not accepting the precast technology by the stakeholders is the inability to ascertain the benefits to a project [7]. Use of precast technology is not understood to the core extent, and sometimes, it is viewed as a costlier technology. A pilot study [8] demonstrated that decisions to use precast are still largely based on circumstantial evidence rather than rigorous data, as no formal measurement procedures or strategies are available. This study is focused on identifying such challenges faced by the precast technology and providing amicable solutions to the challenges identified at the industry level.

2. Literature Review

Precast construction is a stage wise process consisting of producing elements in a factory set environment (as per the required dimensions taken from the drawings), transporting these elements to the site, erecting them at the site and assembling them. Precast is a preferred method and has flexibility in planning and production process until the precast components are delivered as per the schedule [4]. Numerous benefits are associated with adoption of precast on a construction site when compared to conventional systems. Main advantages of precast construction are: reduction in time, reduction of wastage in materials, the lesser requirement of labor at the site, improved quality of the product, enhanced safety at the site, etc. These benefits can help the project in delivering effectively and efficiently [9].

The objective for the adoption of precast construction is to reduce the overall cost and to increase the profitability to all the stakeholders. Considering this objective, the European Union and the UK have an average share of 20-25% about precast systems in construction sector and 40-50% share in northern European countries. Usage of precast

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