

A Detailed Study for Feasibility Analysis of Precast Super Structure in Infrastructure Projects...(A Review)

Mr. Savant Pratik Anilkumar^{1*}, Prof. S. B. Kadam²

¹ PG Student, Dept of Civil Engg, PVPIT Pune

² Professor, Dept of Civil Engg, PVPIT Pune

Abstract - India is a growing nation, and at the moment, its economy is mostly dependent on agriculture and the building industry. A nation's infrastructure must be developed if its industries and overall economy are to expand. Analysis of the infrastructure sector's development bottleneck is essential given the future's predicted increased urbanisation. In order to meet the needs of the client, work or construction must be completed in the 21st century in the shortest amount of time feasible while maintaining high quality. Precast concrete and construction are crucial for quick building because they meet the needs of the client for high quality work in a short amount of time. Precast concrete construction (PCC) technique is only used in infrastructure projects including bridges, monorails, and metro systems. etc.. Metro projects are large-scale public initiatives, thus their prompt completion is crucial from both an economic and convenience perspective. Elevated lines are the preferred option for metro corridors due to cost economics; from a land availability perspective, these corridors are often constructed along the main metropolitan roadways. Traffic flow inside the construction zone is restricted due to Metro construction, making the selection of an appropriate construction approach more relevant and crucial under these circumstances. In-situ construction necessitates extensive lengths of traffic detours or restrictions because metro projects are often linear in form. Cast-in-situ process adds to public annoyance since it needs more time and space. Additionally, cast-in-situ technology is not a favoured choice in terms of the environment. As a result, using precast materials as much as possible in elevated metro projects in cities becomes the obvious choice. This paper focuses on importance of Precast Technology In Infrastructure Projects in metro city.

Keywords - Infrastructure growth, rapid construction, Pune Metro, Precast Super structure

-----X-----

INTRODUCTION

Precast is a straightforward technique that entails creating structural components in the right setting and at the required quality, transporting them to the job site using the appropriate means (e.g., long trucks) and erecting the components where they should be using tower cranes.

Precast construction is a type of building material created by pouring concrete into a reusable mould or form, curing it under controlled conditions, and then transporting it to the construction site and lifting it into position. The precast concrete is given the chance to properly cure and is continuously monitored by plant staff since it is produced in a controlled setting (usually referred to as a precast plant/precast factory). Pre-cast building is becoming more and more important in India's metropolitan environments.

There are several locations in India that offer general pre-cast that is industry-specific, such as buildings,

power distribution, water supply, etc. Once more, this area needs the participation of big names..

Need of Precast Construction: The usage of pre-cast members to manufacture the members quickly while still achieving the appropriate strengths is the latest boom in the construction sector. Pre-cast concrete members have a lot of variety and design freedom, and they may be quickly erected. These members' accomplishments are of the highest calibre. With these, we can simply build greater spans in a single stretch. They cover every area of pre-engineering construction, which makes building simpler.

Pre-cast concrete members are well polished and have a pleasing look. It is not necessary to submit any additional or lengthy forms of work. These architecturally effective and long-lasting members. The project's manpower and maintenance costs are decreased. The fact that there are less building

activities and it is more environmentally friendly are the key benefits of employing these members.

Applications of pre-cast construction.

Pre-cast concrete is being utilised more often these days. Pre-cast concrete is used in a wide range of construction projects, including the construction of buildings (such as columns, beams, and slabs), bridges (such as girders and decks), tunnel lining members, railway spurs, and road pavement blocks.

Pre-cast structural elements.

1. Pre-cast column.
2. Pre-cast beam.
 1. Rectangular beam
 2. Tee beam
3. Staircase.

4. Shear walls
 1. L shaped
 2. T shaped
5. Slabs.
 1. Hollow core
 2. Solid slab
 3. Half slab.

Other Pre-Cast Element

- a) Pre-cast railway sleepers.
- b) Pavement blocks.
- c) Pre-cast hollow pipe.
- d) Aesthetic elements.

LITERATURE REVIEW

The past researchers research in all aspects is covered in this literature review

VPS Nihar Nanyama,(2017) This study develops a cost analysis model for precast technology and compares precast buildings' time and cost factors to those of conventional construction in two ongoing projects. Precast technique has achieved time reductions of 20–35% when compared to the traditional method of In this article, respondents identified the top four obstacles as being economies of scale, high beginning costs, a trained personnel shortage, and leakage problems. A brainstorming session is held with a group of business specialists to come up with acceptable answers to the problems precast technology has in spreading. According to authors, in order to take advantage of economies of scale, the government or key players must take the initiative in investing in precast manufacturing facilities and delivering precast components to all the sites. To increase prospects, the expert panel suggested lowering the extra taxes placed on precast technology. The paper stated that precast technology is used in construction projects with high-quality severe inspections to ensure that leakage concerns are reduced. Through efficient training programmes, the

workforce's skill set must be enhanced to use precast technology. One key finding from the study is that precast technology may be used to save money on projects where there is room for a lot of repetition and standardisation. The precast technology will completely alter the Indian construction industry.

Rangesh M. Jajodia(2017) The majority of the route is raised, and just 02 stations are at grade, therefore the authors discovered that a significant quantity of land is not necessary. The foundation employed is primarily a pile foundation with a cutoff level 1.5 to 2.0 metres below the existing ground, according to the paper. The most appropriate form of foundation was determined through a number of geo-technical analyses, which led to the conclusion that cast-in situ RC piles are the best option. For a project's quick and efficient construction, the segmental technique of building is used.

Ashish Wanve (2019) The author notes that the street-based, present urban transport system in Pune City has recently come under pressure, resulting in increased air pollution, longer journey times, and an increase in street accidents. Fortifying and expanding the transit system is projected to be crucial as the population of the city is likely to increase. This has led to consideration of a rail-based Metro structure in the city. The project has many beneficial ecological effects, such as a reduction in rush-hour gridlock, a reduction in travel time, a reduction in air and noise pollution, a reduction in fuel consumption, a reduction in absolute accidents, and so forth, with a few adverse effects (especially due to the project's duration) for which an environment management plan has been proposed. Paper reported It has been recommended that the Pune Metro Project be carried out through an SPV on a DMRC finance design after analysing the various options for its execution. According to research, the passage structure has been assessed in light of the Delhi Metro tolls selected by the charge preoccupation committee in 2009 and appropriately increased for the year 2018. In this approach, the tolls have been modified every other year with a 12% acceleration at regular intervals in order to measure returns from the work.

David K. (2001) The primary goal of the study, according to the authors, was to ascertain the most recent advancements in precast pavement technology globally as well as in the precast concrete and concrete paving sectors more broadly. The main method used to do this was a thorough literature study. Finding potential precast pavement designs was the second goal. As there was very little literature and experience with precast pavements, potential concepts were principally developed through two expert panel sessions, one at the start of the project and one close to its conclusion. Various experts from the precast industry, the transportation sector, and the concrete paving sector made up the expert panels. The final goal of the study was to conduct a feasibility

analysis on the potential ideas that the literature review and expert panel sessions had generated. The potential concepts were looked at from the angles of design, constructability, economy, and durability. The research's ultimate goal was to develop suggestions for future implementation and standards for performance monitoring of subsequent precast pavement test sections after a workable idea for precast pavement had been created.

Harshit Soni (2017) According to this study, the physical barrier created by the implementation of an elevated system is also smaller than the barrier created by a metro system at street level. Determining the finest building methods is crucial since metro rail development is continuously expanding in our country. Due to the use of subpar building practises in infrastructure projects, India is currently experiencing a severe issue with cost and time overruns, which is a very sad aspect of the construction business. The creation of the project's superstructure accounts for a sizable share of the cost, time, and resources needed for the building of the elevated viaduct. For the building of both the Pier cap and the Girder, a variety of various construction procedures are available. These methodologies have been thoroughly reviewed and five key criteria have been chosen for comparison. This publication makes an effort to evaluate various approaches using the aforementioned standards and pinpoint the ideal strategy for superstructure building.

Sandeep Jain (2016) The authors draw the conclusion that precast building has a significant potential to meet new market demands provided it is conceived and carried out with careful planning. According to the author, there are more advantages to using a combination of factory-made precast units and CIS modules than the conventional "all precast or no precast" strategy in terms of time, cost, and quality. Repetition of precast components, according to the paper, is necessary to achieve the required number for cost efficiency. Precast construction has several benefits over traditional building, including better quality control, reduced construction time and waste, reduced dust and noise levels on the job site, and lower labour costs. Additionally, it leads to an increase in useable gross floor space, which has a major positive impact on costs. The author discovered that seismic zones IV and V can still achieve a significant reduction in the steel factor. If the need occurs, it becomes simple to do non-destructive testing (NDT) and simple to mitigate. The use of non-standard design approaches using modular components to maximise site opportunities and limits has become more common with precast. Precast offers unmatched advantages for commercial building and other common items like boundary walls, etc. Longer clear spans and versatile design options were made possible by precast technology in non-tower locations like parking. Precast is a clever technique to fulfil the green building's sustainability goals.

Pasquire, C. (2002) According to the author, pre-assembly and standardisation can help the building business function better. It can raise profitability, productivity, and predictability while enhancing health and safety conditions and lowering costs, delays, and faults. The elements determining S&P's performance are numerous and will vary in how they effect each project, just as each project's specific factors will differ from one another, according to the paper. According to the paper, in order for S&P to be extensively embraced by the construction sector, benefits must be obvious to all stakeholders and accessible to them. The objectives of the Client and other project stakeholders must be fully taken into account while evaluating the advantage of S&P. The value of S&P to the project and the stakeholders may be quantified in terms of direct costs, but this will not reflect the actual benefit of S&P. Because of this, S&P option will frequently be outperformed by traditional building methods in a cost-only comparison.

Shubham D. (2019) Because building components are cast in the warehouse and then brought to the site for final assembly and installation, the author discovers that prefabrication construction technique creates less waste on site. This results in both time and financial savings. The publication went on to say that it is astonishing to observe how much less expensive and quicker to construct a building utilising prefab technology than using a traditional approach. Prefabrication delivers an environmentally friendly construction and aids in minimising negative environmental effects. Prefab building is therefore significantly more effective and environmentally friendly. If this technology is used for repeated labour, a higher level of quality control may be attained. The author also draws the conclusion that prefab technology is more cost-effective than traditional cast-in-place methods, but there are still a few factors that should be taken into account before employing this technology. Prefabrication technology may be viewed as a potential option in the building sector due to the sustainability factors of social, economic, and environmental sustainability.

Anand Kanade (2018) The most cost-effective and secure segment, according to the paper, may be reached by doing several tests in the shortest amount of time. In all design firms, this kind of atomization is the most beneficial. It is clear that this alternative for segmental box girders is more cost-effective than traditional precast girders. The size of a bridge determines how different weights are involved, as well as in certain situations, how the bridge is to be designed. Design foundation reports must be scrupulously followed while developing any metro railway bridge that complies with the IRS standards.

Akash Lanke (2016) The precast concrete technique is found in the paper to be more cost-

effective than the traditional cast-in-place approach, but there are still several considerations when employing precast, including the quantity of construction and the site's distance from the manufacturing facility. Precast is the ideal alternative to select for routine and repetitive labour, regardless of the kind of construction, etc. The project that has to be monitored the most is the precast building approach since it is more cost-effective and takes less time to build. It requires trained contractors and skilled workers, with lower start-up costs, particularly for large projects. We can produce lighter concrete units and improved concrete quality control. The main limitation of precast is transportation from place of manufacturing to place of site where it is to be fixed.

Mayur P. Choude (2019) This article will examine the specifics of the Pune metro rail project and the feasibility research methods that are used to determine how adequately the Athens, Greece, metro network meets the demands of the city. According to the paper, the NLRI 1.13 and SNRI 1.091 are sufficient for a length of 140 km and 80 stations. Therefore, it is more than the approved plan. The length and stations of the metro are growing since it is now impractical to build one.

SUMMARY

Infrastructure is a huge potential market for precast building. The problem, though, is that cities are densely populated, and traffic is becoming worse every day. Precast is the most practical choice since it expedites building while without obstructing traffic. Thus, precast must be encouraged in infrastructure tenders by the governing bodies. Precast meets the needs for subterranean services, subways, tunnels, highways, pavements, flyovers, and other structures as the country's attempts to turn cities into smart cities gather speed. Even now, the traditional building procedures are not very standardised. There is a considerable likelihood of human mistake and mishaps in complicated undertakings. Different building approaches and labour processes are standardised by precast construction, both on and off site. Precast construction offers effective cost and time management, the two key project drivers. Precast building significantly reduces the need for heavy construction manpower, cost and time overruns, site hazards, time consumption, and resource waste.

CONCLUSION

According to the study, pre-cast concrete is one of the significant and practical building techniques accessible to suit the clients' needs, i.e., speed and high quality in the construction. It is important to address the numerous issues related to this in order to promote its use in the building sector. So that it may be utilised

extensively to speed up construction, reduce construction time, and enhance the quality of the finished product. And that will strengthen our country's economic foundation, employment opportunities, and infrastructure.

REFERENCES

1. VPS Nihar Nanyama, Riddha Basua, Anil Sawhneyb, Harsh Vikrama , Gourav Lodhaa, "Implementation of Precast Technology in India Opportunities and Challenges", Science Direct Creative Construction Conference 2017, CCC 2017, 19-22 June 2017, Primosten, Croatia
2. Rangesh M. Jajodia¹ Prof. K. R. Burkul, "Study of Structural Features of Nagpur Metro", International Journal of Innovative Research in Science, Engineering and Technology. Vol. 6, Issue 11, November 2017.
3. Ashish Wanve , Gaurank Patil, "Constructability & Cost Feasibility Analysis of Pune Metro Rail Project Including Planning & Design Specifications" International Journal of Innovative Research in Science, Engineering and Technology. Vol. 8 Issue 2, November 2019
4. David K. Merritt, B. Frank McCullough, Ned H. Burns, and Anton K. Shindler (2001) Feasibility of Precast Prestressed Concrete Panels for Expediting PCC Pavement Construction", Project Summary Report 1517-S Project 9-1517: Feasibility of Precast Slabs in PCC Pavements
5. Harshit Soni (2017) ," Critical Evaluation of Super Structure Construction for Metro Corridor", International Journal of Engineering Technology Science and Research Volume 4, Issue 9 page 210-219
6. Sandeep Jain (2016)" A CASE STUDY ON USE OF PRECAST TECHNOLOGY FOR CONSTRUCTION OF HIGH-RISE BUILDINGS, Reseacg Gate
7. Pasquire, C.L & Gibb, A.G.F. Considerations for assessing the benefits of standardisation and preassembly in construction, Journal of Financial Management of Property and Construction, Vol. 7, Number 3, December 2002, pp. 151-161, ISSN: 1366-4387
8. Shubham D. Auti¹, Dr. Jalindar R. Patil, "Prefabrication Technology - A Promising Alternative in Construction Industry" International Journal of Science and

Research (IJSR) Volume 8 Issue 8, August 2019

9. Anand Kanade ,” STUDY OF STRUCTURAL ANALYSIS OF PSC BOX GIRDER VIADUCT FOR PUNE METRO” International Journal of Research in Engineering and Technology Volume: 07 Issue: 11 | Nov-2018
10. Akash Lanke, Dr. D. Venkateswarlu ,” Design, Cost & Time analysis of Precast & RCC building” International Research Journal of Engineering and Technology, Volume: 03 Issue: 06 | June-2016
11. Mayur P. Chounde , Milind M. Darade,” FEASIBILITY STUDY OF METRO RAIL PROJECT IN PUNE CITY”, International Research Journal of Engineering and Technology Volume: 06 Issue: 05 | May 2019
12. Ng Ban Kiong, ZainalAbidin Akasah, “An Overview of Precast Concrete System for Building maintenance: Malaysian Perspective”, International Journal of Engineering Science & Advanced Technology.
13. Yakubu Adisa Olawale, (2010), “Cost and Time Control of Construction Projects”
14. Shweta Rai, Prateek Ghavate, Aug 2013, “Current infrastructure scenario and rise in construction and allied industries in India”, International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2.

Corresponding Author

Mr. Savant Pratik Anilkumar*

PG Student, Dept of Civil Engg, PVPIT Pune