IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Cost And Schedule Assessment Of Precast And Cast-In-Situ Construction: A Case Study Transition To Sustainability

Senthil Naathan. B [a], Joseph. L [b], Kumar. A[c]

[a] Assistant Professor, Department of Civil Engineering, RVS Technical Campus, Tamilnadu India.

[b] Post Graduate Student, Department of Civil Engineering, RVS Technical Campus, Tamilnadu, India.

[c] Professor, Department of Civil Engineering, RVS Technical Campus, Tamilnadu India.

Abstract

Introduction: Worldwide, the demand for housing has grown dramatically during the past ten years. It is especially noticeable in nations with rapid economic growth and high rates of population expansion. Many nations use pre-cast concrete technology, which is one of the most economically advantageous and quality-monitored systems.

Objectives: Although numerous studies have looked into various facets of prefabrication in the building industry, a comprehensive analysis of its current state of development that combines environmental, economic, and social sustainability components is still lacking. By creating a systematic framework, examining the research status quos, and making suggestions for future research, this study seeks to close this research gap.

Methods: In this study, the costs of residential building construction for cast-in-situ versus precast concrete were compared. This study also looked into why using a precast concrete approach for building has lower overall costs than using cast-in-place methods. Four cases - complete monolithic construction, partially monolithic construction (walls alone precast and frames alone precast), and entirely precast construction were taken into consideration. The data analysis was carried out using Primavera P6 software.

Findings: After data analysis, it was shown that the cast in-situ construction and pre-cast cost differed significantly. The findings showed that employing the pre-cast construction method, 70.40% of the cost effectiveness and 54.40% of the schedule were attained.

Novelty: The exact cost and schedule effectiveness of cast in-situ and pre-cast construction was reported in this study using Primavera P6 software.

Key Words: Cast in-situ; Cost effectiveness; Precast; Primavera; Construction.

1. Introduction

One of India's most enduring issues has been the housing shortage. It is blatantly obvious from the fact that the census 2011 report listed 13.7 million families as being in slums **[1]**. The exponential growth of this issue has been a result of rising urbanization. India currently lacks more than 20 million homes in urban areas. Approximately 60 crores people would be living in cities by 2031, up from 43.4 crores in 2015, according to reports **[2]**. The union cabinet launched the Ho initiative by 2022 with the intention of constructing 2 crores dwellings for the urban poor in order to overcome the housing deficit **[3]**.

According to the current situation, India has started to industrialize in all areas of development. Today's construction industry is quick, advanced, modern, cost-effective, time-effective, and adopting sustainable building construction methods. **[4]**. Additionally, the building sector has to develop faster and better development methods **[5]**. Because the building industry greatly contributes to the expansion of the world economy. However, the ecology suffers as a result of its rapid development. The International Energy Agency claims that the building industry is the source of the majority of energy consumption and CO2 emissions, which worsens climate change **[6-8].**

A sensible choice of building supplies and techniques not only cuts down on time and labor costs, but also lowers carbon emissions during construction **[6]**. To support the building and construction trades transition to higher efficiency and sustainability, The Singapore Building and Construction Authority (BCA) introduced Prefabricated Prefinished Volumetric Construction (PPVC), a contemporary modular construction method to boost off -site fabrication to assemble on-site **[9]**. As a result of the construction of the Hindustan Housing Factory, prefabrication in India got its start. The organization was created by Pandit Jawaharlal Nehru, the country's first prime minister, as a response to the housing need brought on by the 1950s flood of refugees from West Pakistan. The Hindustan Housing Factory created the first pre-stressed concrete railway sleepers to replace the Indian Railways aging timber sleepers. Soon later, to more accurately represent the range of its business operations, the corporation changed its name. Its current name is HPL, short for Hindustan Prefab Limited. Today, the government-run enterprise, which is based in Delhi, prefabricates predominantly prefabricated concrete for civil and architectural projects across the country of India **[10]**.

Prefabrication, the technique of making building materials outside of the construction site in a workshop before they are installed there, is a crucial component of how modern buildings are constructed. Prefabrication's major objective is to constructing building components in a fruitful setting with admission to expert knowledge and tools in order to decrease total costs and time commitments on site while enhancing quality and uniformity **[11-12]**. Precast construction uses less work than cast-in-place concrete (labor is only needed to link precast parts), costs less to create, and uses less materials overall. Due to the fact that the members are cured for the required number of days at the plant, there is no need to cure them on site following assembly. Time savings during construction will lower construction costs, improve work quality, lower maintenance costs, and avoid shuttering and deshuttering expenses. Rework costs brought on by poor workmanship, flawed construction techniques, untrained personnel, subpar materials, and on-site environmental issues can be avoided **[13]**. However, because of the highly disorganized management of design, construction, and supply chain, off-site precast concrete is subject to numerous risks and limitations. Therefore, a cast-in-place construction technology using industrialized procedures is created to get around this constraint **[6]**. The aforementioned concerns have been the subject of attempts by some researchers **[14-18]**. However, further research must be done to address the problems with precast construction. The problem statement has been identified by gap analysis. Therefore, this study makes an effort to evaluate the efficiency of cast-in-place and precast construction in terms of both time and cost.

The objectives of the study are as follows;

- ✓ To research the precast and cast-in-situ building construction.
- ✓ To predict the time and cost differences between traditional and prefabricated building construction.
- ✓ To ascertain which technique will contribute to a reduction in on-site labor.
- ✓ To investigate potential future applications for precast concrete building.
- ✓ To investigate issues with precast construction technology implementation.

2. Methodology

2.1 Study Area

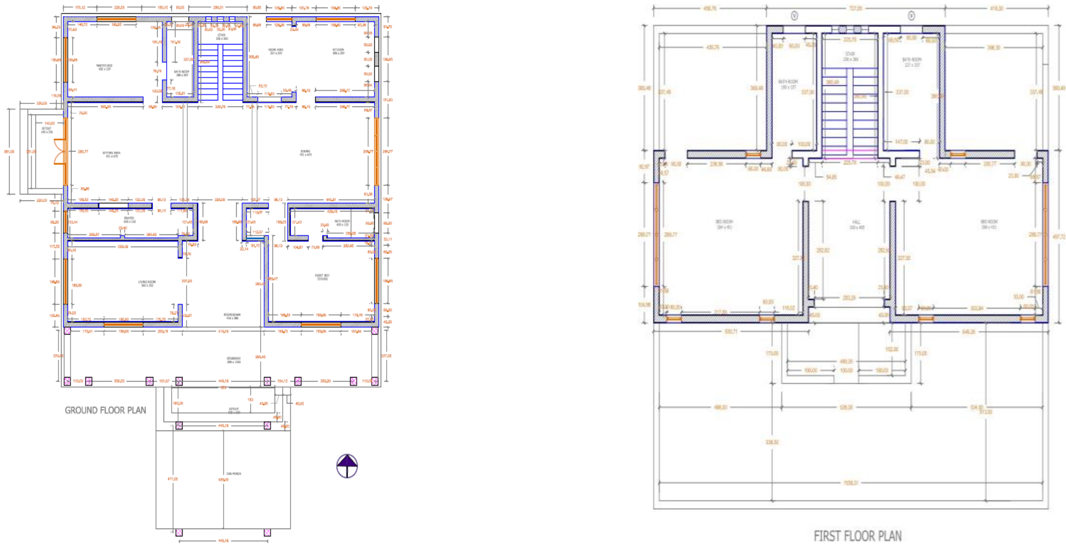
Coimbatore is situated at 11.0161°N 76.971°E and has a surface area of 246.80 km^2. It is surrounded on all sides by the Western Ghats Mountain range, with the Nilgiris Biosphere Reserve and reserve forests on the northern side. The corporation's southern limit is defined by the Noyyal River, which flows through Coimbatore. The average annual rainfall in the region is between 550 and 900 millimeters. The Sulur district's eastern portion receives the least amount of precipitation (550 mm). It gradually ascends toward the south and reaches its top close to the Anamalai Hills.

2.2 Study Population

In 2021, the metro area of Coimbatore had 2,860,000 inhabitants, an increase of 2.62% from the previous year **[1]**.

2.3 Study Plan and Data's

A residential building (G+1) is considered for this study to estimate the quantities of conventional and prefabricated constructions **(Fig. 1 and 2)**. In the process of gathering data, we can learn more about the construction process and its challenges. This collection is useful for calculating the project costs for the two constructions. By employing these inquiries, we are able to determine the construction project's duration as well.



a. Ground Floor Plan **b. First Floor Plan**

Fig. 1 Plan of a Building

Fig. 2 Elevation of a Building

2.4 Prediction of Quantities and Cost

Estimation is used to determine the amount of materials required for both constructions. The details regarding the building materials used were acquired. By acquiring these details, we may make an educated guess regarding the ingredients volume. Finding a assessment between the cost analysis of a building for precast and cast-in-place construction is the project's primary consideration. We wish to take labor and material resources into account in this analysis.

2.5 Tools Used

Primavera P6 is used for analysis.

3. Results and Discussion

3.1 Schedule for Different Building Construction Methods

The nomenclature used in this paper is presented in **Table1**. A schedule may also involve the end of a project with which the public has not yet interacted. A formal timeline is typically created in project management as the first phase of carrying out a given project, such as building a structure, developing a product, or starting a program. To develop a project management schedule, which could also involve employee scheduling, milestones, activities and deliverables must be listed together with their intended start and end dates. A production process is schedule is used organize the production or operation, whereas a resource schedule aids in the logistical planning for resource sharing among numerous entities.

Table 1. Nomenclature

Abbreviations	Descriptions
Method 1	Monolithic Methodology of Construction
Method 2	Frames Constructed in Precast and walls Constructed in Monolithic
Method 3	Wall Panels made of Precast and the Frames made Monolithic
Method 4	Precast Construction

The schedules prepared for the various construction methodologies are shown thorough **Fig. (3) to (6)**. These are scheduled using primavera software. The monolithic methodology of construction requires very higher duration of 219 days for completion, and the super structure which is considered mainly for comparison takes 135 days. The methodology in which the wall panels are made of precast and the frames are made monolithic takes 112 days to complete and the super structure alone takes 103 days to complete. The methodology in the precast construction requires very lesser durationof 100 days for completion, and the super structure which is considered mainly fortaking time requires 67 days. It can be inferred from comparative analysis results that precast method works more quickly than conventional methods. When compared to project planning, almost all precast work methods are day efficient, whereas the use of conventional methods results in a time difference from the planning of the work time. In the meantime, the first floor is the first stage's work, and the contractor has a plan longer than the other work because the first floor has advanced foundation and landfill work, as well as a larger volume of work than other floors. At this stage, using the precast method has a higher time efficiency than using conventional methods because the work on floor plates has sped up. Precast methods have a probability of approaching 50.40% while conventional methods have a capability of approaching project completion planning but only have a probability of approaching 0%. This result has been justified by the results of some researchers **[19-20]**.

MONOLITHIC	2 Week Lookahead			07-Jun-15 21:47	
Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	tivity %
MONOLITHIC		218d 5h	218d 5h	0%	
PROJECT TAKE OVER		0d	0d	0%	
V10	Kick off Meeting	0d	0d	0%	0%
START OF THE PROJECT		27d 2h	27d 2h	0%	
DOCUMENT WORKS		22d 8h	22d 8h	0%	
V20	Site Layout Preparation	3d	3d	0%	0%
V30	Architectural Plan	5d	5d	0%	0%
V40	Structural Drawings	5d	5d	0%	0%
V50	MEP Drawings	5d	5d	0%	0%
V60	Approval and Contract Documents	10d	10d	0%	0%
SITE WORKS		4d 2h	4d 2h	0%	
V70	Site Visit	1d	1d	0%	0%
V80	Marking Site Borders	2d	2d	0%	0%
V90	Cleaning	2d	2d	0%	0%
SUB-STRUCTURE		66d 5h	66d 5h	0%	
V100	Fixing Coordinates	1d	1d	0%	0%
V110	Marking	2d	2d	0%	0%
V120	Placing Dummy Pillars	2d	2d	0%	0%
V130	Earthwork in Excavation	5d	5d	0%	0%
V140	PCC for Foundation	2d	2d	0%	0%
V150	Brickwork at Foundation	12d	12d	0%	0%
V160	Eathwork in Filling	5d	5d	0%	0%
V170	Anti Termite Treatment	1d	1d	0%	0%
V180	Rebar Fabrication for Plinth Beam	2d	2d	0%	0%
V190	Formwork for Plinth Beam	2d	2d	0%	0%
V200	Rebar Placing for Plinth Beam	2d	2d	0%	0%
V210	Concreting Plinth Beam	1d	1d	0%	0%
V220	Curing Brickwork and Plinth Beam	5d	5d	0%	0%
V225	Damp Proof Course	2d	2d	0%	0%
SUPER-STRUCTURE		134d 5h	134d 5h	0%	
GROUND FLOOR		97d 5h	97d 5h	0%	
V230	First Class Brickwork upto Lintel Level	10d	10d	0%	0%
V240	Curing Brickwork	3d	3d	0%	0%
V250	Rebar Fabrication for Lintel	2d	2d	0%	0%
V260	Formwork for Lintel	2d	2d	0%	0%
V270	Rebar Placing for Lintel	1d	1d	0%	0%
V280	Concreting Lintel	1d	1d	0%	0%
V290	Curing Lintel	3d	3d	0%	0%
V300	Brickwork upto ground Floor Slab	2d	2d	0%	0%
V310	Curing Brickwork and Lintel	3d	3d	0%	0%
V320	Rebar Fabrication for Ground Floor Slab	3d	3d	0%	0%
V330	Formwork and Scaffolding for Ground Floor Slab	2d	2d	0%	0%
V340	Rebar Placing at GF Slab	3d	3d	0%	0%
V350	Inspection	1d	1d	0%	0%
V360	Concreting GF Slab	1d	1d	0%	0%
V370	Curing Slab	7d	7d	0%	0%
FIRST FLOOR		118d 5h	118d 5h	0%	
V380	Floor Preparation for Brickwork	1d	1d	0%	0%
V390	Brickwork upto Lintel	8d	8d	0%	0%
	Page 1 of 6	TASK filter: All Activities			
				(c) Primavera Systems, Inc.	

Fig. 3 Schedule for Monolithic Construction

FRAMES PRECAST	2 Week Lookahead			10-Jun-15 07:54	
Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	tivity %
FRAMES PRECAST		150d 3h	150d 3h	0%	
PROJECT TAKEOVER		31d 8h	31d 8h	0%	
INITIATION		0d	0d	0%	
V1000	Kick off Meeting	0d	0d	0%	0%
DOC WORKS		22d 8h	22d 8h	0%	
V1010	Layout Drawings	3d	3d	0%	0%
V1020	Architectural Drawings	3d	3d	0%	0%
V1030	Structural Drawings	3d	3d	0%	0%
V1040	MEP Drawings	3d	3d	0%	0%
V1050	Approval and Contract Documents	5d	5d	0%	0%
V1060	Work Permissions and Order Placing	3d	3d	0%	0%
SITE WORKS		8d 8h	8d 8h	0%	
V1070	Site Clearance	2d	2d	0%	0%
V1080	Marking Site Borders	1d	1d	0%	0%
V1090	Marking Coordinates	2d	2d	0%	0%
V1100	Placing Dummy Pillars	3d	3d	0%	0%
SUB-STRUCTURE		46d 8h	46d 8h	0%	
V1110	Marking for Foundations	2d	2d	0%	0%
V1120	Earthwork in Excavation for Foundations	3d	3d	0%	0%
V1130	PCC for Foundations	1d	1d	0%	0%
V1140	Rebar Fabrication for Foundation	2d	2d	0%	0%
V1150	Formwork Fabrication for Foundation	2d	2d	0%	0%
V1160	Rebar Placing	2d	2d	0%	0%
V1170	Inspection	1d	1d	0%	0%
V1180	Fixing of Dowels for Joints	2d	2d	0%	0%
V1190	Inspection of Dowels	1d	1d	0%	0%
V1200	Concreting for Foundation	2d	2d	0%	0%
V1210	Curing	3d	3d	0%	0%
V1220	Removal of Formwork	1d	1d	0%	0%
V1230	Earthwork in Filling	1d	1d	0%	0%
SUPER-STRUCTURE		108d 3h	108d 3h	0%	
BACK SIDE		18d 2h	18d 2h	0%	
V1240	Fixing Columns upto GF Slab Level	0d 2h	0d 2h	0%	0%
V1270	Placing Gurbel Beam	0d 2h	0d 2h	0%	0%
V1280	Connecting Columns and Gurbel Beam	0d 2h	0d 2h	0%	0%
V1290	Placing Slab over Gurbel Beam	0d 2h	0d 2h	0%	0%
V1300	Sealing all Joints	0d 2h	0d 2h	0%	0%
V1310	Curing	3d	3d	0%	0%
V1320	Inspection	1d	1d	0%	0%
V1330	Fixing Columns upto FF Slab Level	0d 2h	0d 2h	0%	0%
V1360	Placing Gurbel Beam	0d 2h	0d 2h	0%	0%
V1370	Connecting Columns and Gurbel Beam	0d 2h	0d 2h	0%	0%
V1380	Placing Slab over Gurbel Beam	0d 2h	0d 2h	0%	0%
V1390	Sealing all Joints	0d 2h	0d 2h	0%	0%
V1400	Curing	3d	3d	0%	0%
V1410	Inspection	1d	1d	0%	0%
V1420	Fixing Columns upto Head Room Slab Level	0d 2h	0d 2h	0%	0%
V1450	Placing Gurbel Beam	0d 2h	0d 2h	0%	0%
V1460	Connecting Columns and Gurbel Beam	0d 2h	0d 2h	0%	0%
	Page 1 of 8	TASK filter: All Activities			
				(c) Primavera Systems, Inc.	

Fig. 4 Schedule for Monolithic Construction

WALLS PRECAST | 2 Week Lookahead | 10-Jun-15 07:58

Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	tivity %
WALLS PRECAST		112d	112d	0%	
PROJECT TAKEOVER		31d 8h	31d 8h	0%	
INITIATION		0d	0d	0%	
V1000	Kick off Meeting	0d	0d	0%	0%
DOC WORKS		22d 8h	22d 8h	0%	
V1010	Layout Drawings	3d	3d	0%	0%
V1020	Architectural Drawings	3d	3d	0%	0%
V1030	Structural Drawings	3d	3d	0%	0%
V1040	MEP Drawings	3d	3d	0%	0%
V1050	Approval and Contract Documents	5d	5d	0%	0%
V1060	Work Permissions and Order Placing	3d	3d	0%	0%
SITE WORKS		8d 8h	8d 8h	0%	
V1070	Site Clearance	2d	2d	0%	0%
V1080	Marking Site Borders	1d	1d	0%	0%
V1090	Marking Coordinates	2d	2d	0%	0%
V1100	Placing Dummy Pillars	3d	3d	0%	0%
SUB-STRUCTURE		45d 8h	45d 8h	0%	
V1110	Marking for Foundations	2d	2d	0%	0%
V1120	Earthwork in Excavation for Foundations	3d	3d	0%	0%
V1130	PCC for Foundations	1d	1d	0%	0%
V1140	Rebar Fabrication for Foundation	2d	2d	0%	0%
V1150	Formwork Fabrication for Foundation	2d	2d	0%	0%
V1160	Rebar Placing	2d	2d	0%	0%
V1170	Inspection	1d	1d	0%	0%
V1180	Fixing of Dowels for Joints	2d	2d	0%	0%
V1190	Inspection of Dowels	1d	1d	0%	0%
V1200	Concreting for Foundation	1d	1d	0%	0%
V1210	Curing	3d	3d	0%	0%
V1220	Removal of Formwork	1d	1d	0%	0%
V1230	Earthwork in Filling	1d	1d	0%	0%
SUPER-STRUCTURE		103d 5h	103d 5h	0%	
BACK SIDE		23d 6h	23d 6h	0%	
V1240	Columns Rebar upto GF Slab Level	2d	2d	0%	0%
V1250	Placing Wall Panels	0d 2h	0d 2h	0%	0%
V1260	Joining Columns to Wall Panels	0d 2h	0d 2h	0%	0%
V1270	Placing Gurbel Beam over Wall Panels	0d 2h	0d 2h	0%	0%
V1280	Connecting Columns and Gurbel Beam	0d 2h	0d 2h	0%	0%
V1290	Slab Concreting over Gurbel Beam	2d	2d	0%	0%
V1300	Sealing all Joints	0d 2h	0d 2h	0%	0%
V1310	Curing	1d	1d	0%	0%
V1320	Inspection	1d	1d	0%	0%
V1330	Raising Columns upto FF Slab Level	2d	2d	0%	0%
V1340	Placing Wall Panels	0d 2h	0d 2h	0%	0%
V1350	Joining Columns to Wall Panels	0d 2h	0d 2h	0%	0%
V1360	Placing Gurbel Beam over Wall Panels	0d 2h	0d 2h	0%	0%
V1370	Connecting Columns and Gurbel Beam	0d 2h	0d 2h	0%	0%
V1380	Slab Concreting over Gurbel Beam	2d	2d	0%	0%
V1390	Sealing all Joints	0d 2h	0d 2h	0%	0%
V1400	Curing	1d	1d	0%	0%
V1410	Inspection	0d 2h	0d 2h	0%	0%

Page 1 of 8 | TASK filter: All Activities | (c) Primavera Systems, Inc.

Fig. 5 Schedule for Method 3

PRECAST | 2 Week Lookahead | 17-Jun-15 11:49

Activity ID	Activity Name	Original Duration	Remaining Duration	Planned Start	Pla Fin
PRECAST		85d 4h	85d 4h	01-Jul-15	24
PROJECT TAKEOVER		28d	28d	01-Jul-15	28
INITIATION		0d	0d	01-Jul-15	01
V1000	Kick off Meeting	0d	0d	01-Jul-15	
DOC WORKS		20d	20d	01-Jul-15	20
V1010	Layout Drawings	3d	3d	01-Jul-15	03
V1020	Architectural Drawings	3d	3d	04-Jul-15	06
V1030	Structural Drawings	3d	3d	07-Jul-15	09
V1040	MEP Drawings	3d	3d	10-Jul-15	12
V1050	Approval and Contract Documents	5d	5d	13-Jul-15	17
V1060	Work Permissions and Order Placing	3d	3d	18-Jul-15	20
SITE WORKS		8d	8d	21-Jul-15	28
V1070	Site Clearance	2d	2d	21-Jul-15	22
V1080	Marking Site Borders	1d	1d	23-Jul-15	23
V1090	Marking Coordinates	2d	2d	24-Jul-15	25
V1100	Placing Dummy Pillars	3d	3d	26-Jul-15	28
SUB-STRUCTURE		39d	39d	10-Jul-15	17
V1110	Marking for Foundations	2d	2d	29-Jul-15	30
V1120	Earthwork in Excavation for Foundations	3d	3d	31-Jul-15	02
V1130	PCC for Foundations	1d	1d	03-Aug-15	03
V1140	Rebar Fabrication for Foundation	2d	2d	10-Jul-15	11
V1150	Formwork Fabrication for Foundation	2d	2d	04-Aug-15	05
V1160	Rebar Placing	2d	2d	06-Aug-15	07
V1170	Inspection	1d	1d	08-Aug-15	08
V1180	Fixing of Dowels for Joints	2d	2d	09-Aug-15	10
V1190	Inspection of Dowels	1d	1d	11-Aug-15	11
V1200	Concreting for Foundation	1d	1d	12-Aug-15	12
V1210	Curing	3d	3d	13-Aug-15	15
V1220	Removal of Formwork	1d	1d	16-Aug-15	16
V1230	Earthwork in Filling	1d	1d	17-Aug-15	17
SUPER-STRUCTURE		67d 4h	67d 4h	01-Jul-15	06
BACK SIDE		8d 5h	8d 5h	18-Aug-15	26
V1240	Fixing Columns upto GF Slab Level	0d 2h	0d 2h	18-Aug-15	18
V1250	Placing Wall Panels	0d 2h	0d 2h	18-Aug-15	18
V1260	Joining Columns to Wall Panels	0d 2h	0d 2h	18-Aug-15	18
V1270	Placing Gurbel Beam over Wall Panels	0d 2h	0d 2h	18-Aug-15	18
V1280	Connecting Columns and Gurbel Beam	0d 2h	0d 2h	18-Aug-15	19
V1290	Placing Slab over Gurbel Beam	0d 2h	0d 2h	19-Aug-15	19
V1300	Sealing all Joints	0d 2h	0d 2h	19-Aug-15	19
V1310	Curing	1d	1d	19-Aug-15	20
V1320	Inspection	0d 2h	0d 2h	20-Aug-15	20
V1330	Fixing Columns upto FF Slab Level	0d 2h	0d 2h	20-Aug-15	20
V1340	Placing Wall Panels	0d 2h	0d 2h	21-Aug-15	21
V1350	Joining Columns to Wall Panels	0d 2h	0d 2h	21-Aug-15	21
V1360	Placing Gurbel Beam over Wall Panels	0d 2h	0d 2h	21-Aug-15	21
V1370	Connecting Columns and Gurbel Beam	0d 2h	0d 2h	21-Aug-15	21
V1380	Placing Slab over Gurbel Beam	0d 2h	0d 2h	21-Aug-15	22
V1390	Sealing all Joints	0d 2h	0d 2h	22-Aug-15	22
V1400	Curing	1d	1d	22-Aug-15	23
V1410	Inspection	0d 2h	0d 2h	23-Aug-15	23

Page 1 of 8 | TASK filter: All Activities | (c) Primavera Systems, Inc.

Fig. 6 Schedule for Method 4

3.2 Quantity and Cost for Different Building Construction Methods

The process of gathering and confirming the capital expenses for a project from its inception to its completion is known as project costing. Quantity surveyors and other specialists' knowledge gets more precis and clear when the concept transforms into detailed plans and designs. The project pricing procedure becomes more exact once contractor prices are acquired and municipal approval expenses are determined. To successfully finance the project and promote our units, accurate financial data is crucial. The cost for all the four methods is displayed in **Table** 2. The comparison among the all four methods of construction is shown in **Fig. 7.** After data analysis, it was shown that the costs of pre-cast and cast in-situ construction techniques differed significantly. The findings showed that employing the pre-cast construction method, 70.40% of the cost effectiveness were attained. This finding was confined by the results of some authors **[21-26]**.

Table 2. Comparison of Cost and Schedule and Percentage Variation

S.No.	Methodology	Cost (Rs.)	Duration (days)	Variation in Cost (%)	Variation in Schedule (%)
1.	Completely Monolithic Construction	21,58,392	219	0	0
2.	Partially Monolithic Construction (Precast Frames)	24,03,376	109	11.40	-50.30
3.	Partially Monolithic Construction (Precast Frames)	33,08,624	112	53.30	-48.90
4.	Completely Precast Construction	36,77,600	100	70.40	-54.40

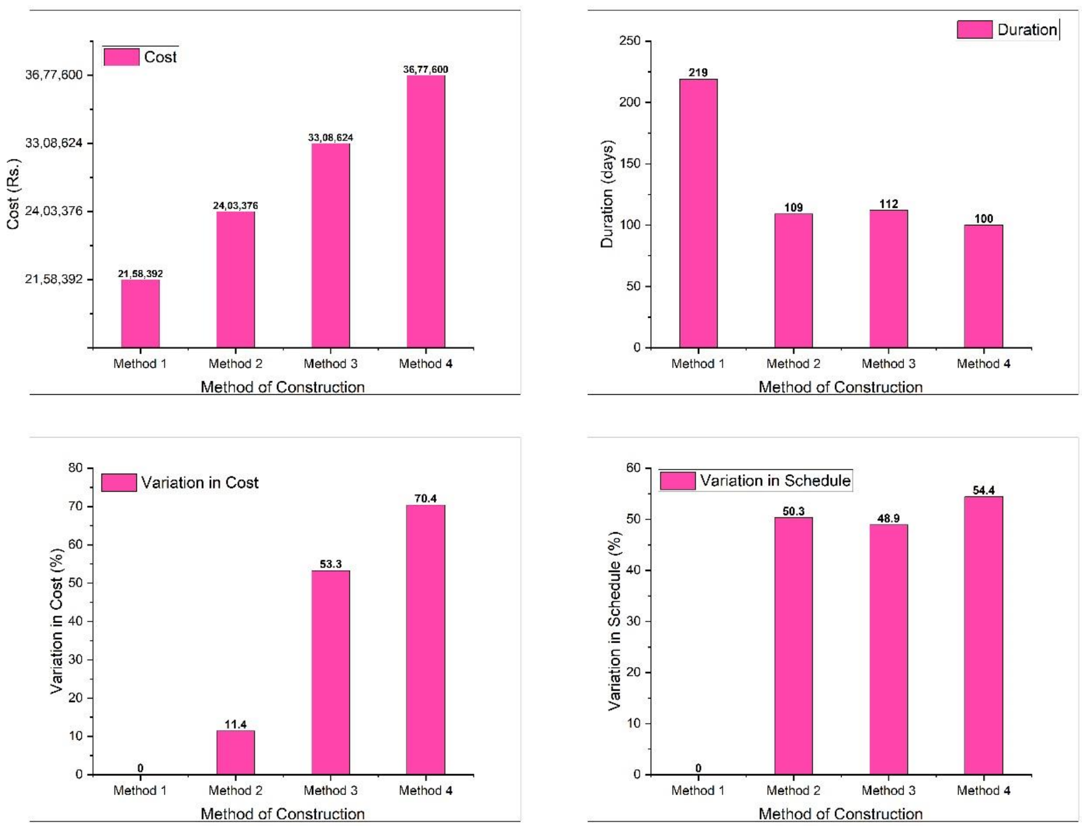


Fig. 7 Comparison of Results

4. Conclusion

If the factors of time, quality, and ease of erection are taken into account, the precast construction has become a profitable methodology. However, when joint stability, cost, and customer reliability are taken into account, the monolithic design also exhibits some benefits. In this study, the benefits of both techniques are compared. Precast construction scheduling and estimation techniques have been examined with industry. To get the best outcome in terms of cost and schedule, a common design for precast and monolithic construction has been established. Cost and schedule estimates for total precast construction, total monolithic construction, and the various combinations have been generated and compared. Data study revealed a considerable difference between the costs of cast-in-situ and pre-cast construction technologies. According to the research, 70.40% of the cost effectiveness and 54.40% of the schedule were satisfied when using the pre-cast construction method. The analysis makes it very evident that precast construction approach requires significantly less time than monolithic construction methodology.

5. References

1. 2011. [Online]. Available: censusindia.gov.in, 2011.
2. 2016. [Online]. Available: http://www.ibef.org/, 2016.
3. VPS Nihar Nanyam, Riddha Basu, Anil Sawhney, Harsh Vikram, Gourav Lodha. Implementation of Precast Technology in India Opportunities and Challenges. *Procedia Engineering*. 2017, 196, 144-151.
4. Dhiraj Tapkir, Dhawale. Comparative Study of Conventional (Cast in-situ) & Pre-cast Method for Residential Project. Journal of Advances and Scholarly Research in Allied Education. 2018, XV (2), 390-394.
5. Aman Agarawal, Sanghai S.S, Kuldeep Dabhekar. Comparative Studies between Precast and Conventional Cast In-situ Structural System. IOP Conference Series: *Materials Science and Engineering*. 2021.
6. Cong Liu, Fangqing Zhang, Hong Zhang. Assessment of physiochemical characteristics of drinking water quality in Allahabad metropolitan city, India. *The Oriental Anthropologist*. 2019, 19(1), 121-135.
7. Zezhou Wu, Lirong Luo, Heng Li, Ying Wang, Guoqiang, Maxwell Fordjour Antwi-Afari. An Analysis on Promoting Prefabrication Implementation in Construction Industry towards Sustainability. *International Journal of Environmental research and Public Health*. 2021, 18, 11493-11513.
8. Sripathy L, Naveen Chandra. 2020. Comparative Analysis of Off-site Precast Concrete and Cast-in-place Concrete in Low-Carbon Built Environment. *Fresenius Environmental Bulletin*. 2020, 29 (3), 1804-1812.
9. Mizanoor Rahman, Habibur Rahman Sobuz. 2018. Comparative Study of IPS & PPVC Precast System - A Case study of Public Housing Buildings project in Singapore. Proceedings of the *International Conference on Civil Engineering for Sustainable Development*. 2018.
10. Suraj Kumar A. Comparative Study on Precast/Prefabricated Structures and cast In-situ Structures. *International Journal of Science and Research*. 2018, 1(6), 161-163.
11. Manbhawan Singh, Jatin Mehta, Kapil Soni. 2019. Study on Comparison of precast and Cast in-situ Construction of the Structure Based on Social Category. *International Journal of Innovative Science, Engineering & Technology*. 2019, 2(4), 527-532.
12. Vidyarani Kshirsagar, Pratik Anilkumar Savant. Comparative Study on Precast Construction Conventional Construction. *International Journal of Advances in Engineering and Management*. 2021, 3(7), 2144-2146.
13. Sunishtha, Himmi Gupta, Parvinder Singh Sond. A Review Paper on Comparative Delta Analysis of Structural Quantities for Different Construction Systems. *Journal of Emerging Technologies and Innovative Research*. 2019, 6(4), 97-99.
14. Ajay Sansanwal A. Comparative Study between Prefabricated and Conventional residential Accommodation. *International Journal of Civil Engineering and Technology*. 2019, 10(11), 356-364.
15. Prasanna, Chandrasekar. A Comparative Study on Various Techniques in Construction Industry. *International Journal of Scientific & Engineering Research*. 2016, 7(4), 85-90.
16. Rahul Khobragade, Shrikant Bhuskade. Comparative Study on Precast Staircase - A Review. *International Journal of Innovative Research in Science, Engineering and Technology*. 2021, 10(6), 8041-8044.
17. Shubham Raghvani, Niheeta Harwande, Piyush Khose, Nikhil Ubale, Siddhartha Ray. Review on

Comparative Study of International Codal Provision for Precast Construction. *International Journal of Scientific and research Publications*. 2022, 12(4), 312-316.

18. Suraj Kanase, Gajanan Gaikwad, Pravin Bhalerao, Shreyas Ladage, Pooja Chandgude. Study on comparison between Prefabricated and Conventional Structures. *IJSART*. 2021, 7(5), 5-10.
19. Arviga Bigwanto, Irwan Tani, Teknik SIpil, Fakultas Sains dan Teknolgi, Universitas Peltia Harapan. The comparison Analysis of Precast and Conventional Methods of the Project Working Time. *International Journal of Education and Research*. 2019, 7(12): 101-120.
20. Ashish Kumar, Dharmendra Singh. Analysis of Precast & Cast in-situ Construction of the Structure. *International Journal for Technological Research in Education*. 2022, 8(7),1-3.
21. Dengama, Jayasooriya. Comparative Analysis of Precast Construction and Conventional Construction of Small-scale Concrete Building in terms of Cost. *International Journal for Research in Applied Science & Engineering Technology*. 2023, 11(II), 573-578.
22. Dinesh Kumar, Kathirvel. Comparative Study on Prefabrication Construction with Cast in-situ Construction of Residential Buildings. *International Journal of Innovative Science, Engineering & Technology*. 2015, 2(4), 527-532.
23. Marzena Kurpinska, Beata Grzyl, Adam Kristowski. Cost Analysis of Prefabricated Elements of the Ordinary and Light Weight Concrete Walls in Residential Construction. *Materials*. 2019, 12, 3629-3642.
24. Richard Oduro Asamoah, John Solomon Ankrah, Kofi Offei-Nyako, Ernest Osei Tutu. Cost Analysis of Precast and Cast -in -Place Concrete Construction for Selected Public buildings in Ghana. *Journal of Construction Engineering*. 2016, 1(1), 1-10.
25. Syahrizal Muhammad, Hidayat Sutanto, Santosa Agus. Cost, Time and Quality of Precast Concrete Construction and In-situ Concrete at Macro Channel in Control of Run-off: A Case Study of Regional Harun Naafi Street in Samarinda. *RJOAS*. 2017, 69(9), 155-163.
26. Vaishali Turai, Ashish Waghmare. A Study of Cost Comparison of Precast vs. Cast in-place *International Multidisciplinary E-Journal*. 2015, IV(XI), 27-34.