



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 10, October 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.524

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Analysis of Time and Cost Using Precast Construction Technology in Residential Sector

Madam Pooja Santosh^{*1}, Prof. Gaikwad Prajwal Jaywant^{*2}

Student, Department of Civil Engineering, Shri. Chh. Shivajiraje College of Engineering, Dhangwadi, Pune,
Maharashtra, India^{*1}

Project Guide, Department of Civil Engineering, Shri. Chh. Shivajiraje College of Engineering, Dhangwadi, Pune,
Maharashtra, India^{*2}

ABSTRACT: The traditional cast in situ method of building is used in the majority of construction projects in India. In India, however, there is still a significant demand for residential building. As a result, construction must proceed at a significantly faster pace. This is impossible to create using traditional construction methods.

It is possible to accomplish so using precast concrete construction. Furthermore, precast concrete construction has a number of advantages over traditional concrete construction. As a result, numerous types of literature are investigated and reviewed, some of which are listed in this paper. Precast engineering's unique approach to building adds a new dimension to civil engineering and expands potential in the country's construction industry. Without a doubt, it is one of the most beneficial construction techniques, and it is hoped that it will become a leader in the development of housing areas in our country. The following research examines many areas of precast construction engineering, including materials, design, and calculations, as well as economic benefits and limitations.

KEYWORDS: precast, conventional, Construction management, precast construction, time and cost analysis, quality and productivity

I. INTRODUCTION

Precast is a simple technique that entails producing structural elements in the proper or good environment, as well as to the required quality, then transporting them to the job site in the proper or good environment (i.e. on trailers, long trucks) and erecting these elements on the proper location as shown in the drawing with the help of tower cranes. Precast construction is a type of construction that involves pouring concrete into a reusable mold or form, curing it in a controlled environment, then transporting it to the job site and lifting it into position. Precast concrete is given the opportunity to cure properly and be continuously monitored by plant staff by being produced in a controlled setting (usually referred to as a precast plant/precast factory). In the Indian context, pre-cast construction is gaining traction, particularly in metropolitan areas. General Pre-Cast, which is sector specific, such as buildings, power distribution, and water supply, is dispersed throughout India. This area, too, necessitates the participation of prominent actors.

Factors Affecting Construction Cost

There are many factors which affect the construction cost estimate and have significant impact on project cost and they areas following:

1.1 Problem Definition

"To investigate the growing demand" cost & time issues can be reduced by making informed decisions throughout the construction process, although further research is needed. This could include research into decision communication, the content of construction

site manager training programmes, the value of apprenticeship schemes to provide a more skilled workforce, and the possibilities of greater use of pre-cast materials, among other things. This study identified the causes of construction project delays in India."

From the Literature review analysis it can be said that the precast concrete system is economical than conventional cast

in place method, The cost difference is found to be around in er. but still there are some conditions which we have to take care of while using precast, those are quantity of construction, Distance of site from manufacturing unit. Type of building etc. we have identified that for standard & Repetitive work precast is the best option to choose.

1.2 Aims and Objectives

- To study application of Precast Construction technology for executing large scale construction projects like housing, commercial, institutional buildings etc.
- To find different component and connection of precast technology to reduce time and cost
- To study latest addition in precast concrete technology to improve sustainability of residential project in Pune region
- To prepare general guideline to execute residential building using precast construction technology

II. METHODOLOGY

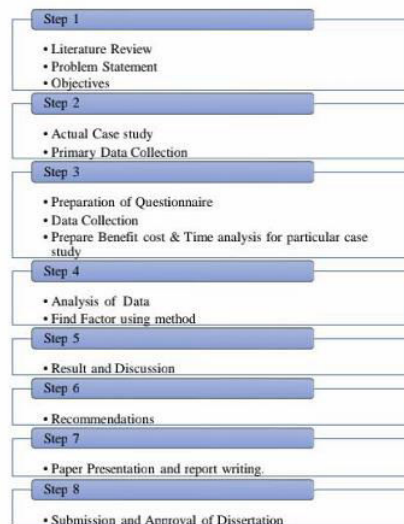


Figure1: Methodology chart

The surveys and research findings indicate that incidents occur mainly during the construction phase of a project and one or more parties usually contribute to delay. This paper highlights the importance of having more experienced and capable construction managers as well as skilled labor to enable the industry to develop at a faster rate either nationally or internationally.

A questionnaire and personal interviews have formed the basis of this research. Factor analysis and regression modelling were used to examine the significance of the delay factors. From the factor analysis, most critical factors of construction delay were identified as

- Lack of commitment;
- Inefficient site management;
- Poor site coordination;
- Improper planning;
- lack of clarity in project scope;
- lack of communication; and
- Sub-standard contract.

SITE DATA

Project Detailed:

Structure Type: Commercial, Residential Building Construction Name of the project: Green Republic, Moshi, Dehu Road, Name of the builder: Samrat Buildcon Pvt. Ltd.

Date of Commencement: November 2027 Completion period: 48 Months Construction Type: RCC Frame Structure.

Location: Moshi, Dehu Road

No. of Floor: G+18 Commercial, And Town Ship (G+22) and Bungalow Plots

Total Area of Building: 5, 15000Sq.ft. RCC Contractor Name: Mr. Tilekar Authority Engineer: Harshi Chaddha

Local Authority: Pune Municipal Corporation, Pune

Walls: 230 mm thick brick masonry walls only at periphery.

RCC Design Consultant: G. A. BHILLARE STRUCTURAL CONSULTANT PVT LTD.

Work Sequence

- Soil investigation
- Area grading along with level charts
- Lineout
- Excavation
- Anti-termite below foundation
- PCC below footing
- RCC below plinth:-
- Footing
- Stub Column
- Plinth beams, Provision for sleeves for services.
- Plinth filling with compaction
- Anti-termite at plinth level.
- Rubble soling, soft murrum, filling, plinth/parking PCC
- RCC Columns, beams, slabs
- Reference level marking on columns
- Hacking after de-shuttering of RCC members
- Masonry work (internal & external)
- Lineout, Brick masonry up to sill level and up to lintel level with openings.
- Masonry work up to lintel level along with fixing of door frames
- Concrete bands at 1.0m height
- Internal Plaster Level pads for fixing electrical sunken boxes, DB's
- Chasing and fixing of electrical sunken boxes and holes for out Jet plumbing pipes.
- Back coat plaster for toilet and Kitchen area, Concealing of plumbing pipes & pressure test, finishing concealed parts, marking for dado tile in kitchen and toilet.
- Installation of kitchen platform vertical & horizontal kadappa.
- Waterproofing Base coat for toilet sunk with provision of leak spout for toilets.
- Laying and fixing of internal plumbing pipes on floor along with proper finishing of Wholes in water proofing-s along with nah.ni traps
- Sunk filling with waterproof finishing on top
- Fixing of MS window grills, Railing with anchors.
- External Plaster-RCC ghadai, masonry joint filling below beams, chicken mesh on RCC & Masonry joints, Plaster level pads, watering to masonry work.

External plaster work

- waterproofing for attached terrace and main terrace
- Duct Plaster, External plumbing lines
- First coat of external paint on walls/railing/Grills
- Internal plaster work for walls and ceiling, level pads for tiling work with level marking on walls Fixing of dado lites and flooring for toilet, Mosaic tiles below wooden floor.
- Flooring and skirting for the rooms along with acid wash, covering of floor lites with Dura sheet
- Internal Electrical wiring work.
- First coat of internal paint. fixing of switches & switch boards with electrical point testing.
- Fixing of doorshutters, fixtures, fittings and first coat of polishing to veneer door shutter. Fixing of all sliding doors, windows.
- Modular kitchen work/AC unit fixing work
- Fixing of cap and sanitary wares along with pressure test, fixing of Geysers/Boiler.
- Toilet false ceiling work & cubical shower panel work

- Wooden flooring work
- Final coat of internal paints with proper covering of door and electrical accessories.
- Deep cleaning work
- External paint work (final coat)
- Silicon sealant for all windows, doors, kitchen sink, wash basin, cupboard, and bath tubs

EXECUTION

Various activities were carried out on site during tenure of my site visit like

- Formwork
- Reinforcement
- Shuuring
- Concreting
- Waterproofing
- Block-work
- Plastering
- Gypsum, etc.

Activities were shuttering is used

COLUMN:

- **STARTER OF COLUMN:** Starter is a small piece of column which is cast before the main column is cast.
- **STEPS:**
- Line dori to be tied between the two starters 10 check the orientation of column.
- Fix the starter as per the drawing.
- Provide proper cover and give the support at all sides of starter.

COLUMN FORMWORK ERECTION:

- The RMD plate of the size of the column is erected on the opposite sides.
- The RMD plates are tied together using tie rod and sbikanja
- Doka is applied on the other two sides of the column and tied using square tube.
- Channel Waller is used to support the RMD plate.
- Spigot tube is provided to support the entire shuttering from both sides.

BEAM FORMWORK ERECTION:

For beams and slab, the base is set up first. The base plates are placed at the bottom at specified distance and a cup lock horizontal is fixed on top of the base plate and cup-lock verticals are fixed on top of the horizontals.

The cup-lock horizontals are provided at a distance 1500mm from each other.

Adjustable u-jack are provided after the desired height is reached using the cup-lock system.

ISMB (International Standard Medium Channels) are fixed on the u-jack.

For the beam bottom, SQ tubes are placed on the ISMB channels at specified distance.

Beam side shutter are placed and supports are provided at specified distances.

Wooden runner placed on top of the channels forming the base of the beam.

SLAB FORMWORK ERECTION:

The base for the slab is same as the base for beam. Cup lock system is used for the shuttering of slab.

Ply is used as a base for the slab. The leveling of slab is done using auto level.

The level of the slab is checked by the client before the reinforcement of the slab is started.

ROLLING MARGIN: It is deviation of actual unit weight to that of standard unit weight of Steel as per IS standard.

STEPS:

The bar is cut to a length of 1.5m for 8mm, 10mm, 12mm, 16mm, 20mm, 25mm and 30mm diameter bars and to a length of 1.6m for 32mm diameter bar.

The bar is then weighed. The weight obtained is the practical weight of the bar.

Then the weight per meter is calculated.

The theoretical weight of the bar is calculated using the formula $d^2/162$.
The percentage difference with respect to theoretical weight is calculated.
For 8mm and 10mm diameter bars rolling margin should be +/- 7%. For 12 and 16mm diameter bars, rolling margin should be +/- 5% For 20mm, 25mm and 32mm diameter bars, rolling margin should be +/- 3%

MATERIALS USED IN REINFORCEMENT BENDING WIRE:

Made of GI with Double Fold

18 Gauge Binding Wire is used

It is used for binding the bars so that they are not displaced and distance between the bars remains constant. The distribution bars are placed on the top of Lbe main bars. It is placed along the longer span. Lesser diameter bars are used as distribution bars since it is only 10 resist Lbe cracks developed due 10 shear stress on top of the slab.

COVER BLOCKS

Cover Blocks are used 10 keep a uniform spacing between formwork and reinforcement for durability purpose.

Steps For Making Cover Blocks on Site

The mortar is then placed into the mould of the specific diameter. The mortar is leveled using trowel.

Cement is then applied on top of the mortar.

The cement is then removed from the top of the mould. Mortar and the cover blocks are removed from Lbe mould the cover blocks are Lben placed in water for curing.

As per drawing cover should be provided based on exposure condition

As per IS Code Cover for various structure is as shown below

Reinforcement for Various Activities One-Way Slab

The one-way slabs are provided with bent up on two sides of the slab. Their ratio of length 10 width is more than 2

REINFORCEMENT OF A TWO-WAY SLAB



The two-way slabs are provided with bent up on four sides of the slab. Their ratio of length 10 width is less than 2

Main Bars and Distribution Bars

Main bars are provided at the bottom of Lbe slab. The purpose of the main bar is 10 transfer Lbe bending load developed at the bottom of Lbe slab 10 the beams. Main bars are placed along Lbe shorter span.

STAGGERED REINFORCEMENT: It is provided to prevent the formation of weak zone in a column. If staggered reinforcement is not provided, the entire load of the column may fall at a particular place leading to the formation of a weak zone and the column may collapse.

STIRRUPS AND RING

When provided vertically, it is called stirrup while when provided in a horizontal direction, it is called as a ring. Stirrups are provided at less spacing at left and right span 10 provide anchorage. Rings are provided in beam on left and right span so that it can hold the entire beam together during earthquake and other natural calamities.

Concreting

Material Used

Cement: OPC 53 Grade cement is required to conform 10 BIS specification and IS: 12269-1987 with a designed strength for 28days being a minimum of 53 MPa or 530 kg/sq cm.

Aggregates: Aggregates should be in compliance with IS383

Water: Aggregates should be in compliance with IS 3025

Admixture: Admixture should be in compliance with IS 9103 (1999) and of reputed brand like Sika, Basf, Pidilite etc.

Test Performed On Site On Various Materials:

Cement:

Date of Packing: Date of manufacture should be seen on Lbe bag. It is important because Lbe strength of cement reduces with age.

Colour: The cement should be uniform in colour. In general the colour of cement is grey with a light greenish shade. The colour of cement gives an indication of excess lime or clay and the degree of burning.

Robbing: Take a pinch of cemeru between fingers and rob it. It should feel smooth while robbing. If it is rough. that means adulteration with sand.

Hand Insertion: Thrust your hand into thecement bag and ii should give cool feeling. It indicates that no hydration reaction is taking place in the bag.

Float Test: Throw a small quantity of cement in a bucket of water. It should sink and should 001 float on the surface.

Smell Test: Take a pinch of cement and smell iL If the cement contains too much of pounded clay and silt as an adulterant, the paste will give an earthy smell.

Presence of Lumps: Open the bag and see that lumps should not be present in the bag. It will ensure that no setting has taken place.

Shape Test: Take IOOg of cement and make a stiff paste. Prepare a cake with sharp edges and put on the glass plate. Immerse this plate in water. Observe that the shape shouldn't get disturbed while settling. It should beable to set andattain strength. Cement is capable of setting under water also and that is why it is alsocalled 'Hydraulic Cement'.

Strength Test: A block of cement 25 mm*25 mm and 200 mm Jong is prepared and it is immersed for 7 days in water. It is then placed on supports 15000 mm apart and it is loaded with a weight of 340 N. the block should not show any sign of failure.

Date of Packing: Date of manufacture should be seen on the bag. It is important because the strength of cement reduces with age.

Colour: The cement should be uniform in colour. general the colour of cement is grey with a light greenish shade. The colour of cement gives an indication of excess lime or clay and the degree of burning.

AGGREGATES:

Test for Silt Content Test of Sand: The maximum quantity of silt in sand shall not exceed 8%. Ene aggregate containing more than allowable percentage of silt shall be washed so as to bring the silt content within allowable limits.

Test for Grading of sand: On the basis of particle size, fine aggregate is graded into four zones. Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron IS sieve, by a total amount not exceeding S percent, it shall be regarded as falling within that grading zone

IS Sieve	Percentage passing for			
	Grading Zone I	Grading Zonell	Grading Zone III	Grading Zone IV
10mm	100	100	100	100
4.75mm	90- 100	90- 100	90-100	90- 100
2.36mm	60-95	75- 100	85 - 100	95- 100
1.18 mm	30-70	55-90	75 - 100	90- 100
600 micron	15- 34	35-59	60-79	80- 100
300 microns	5-20	8-30	12-40	15-50
150	0-10	0-10	0-10	0-15

microns				
---------	--	--	--	--

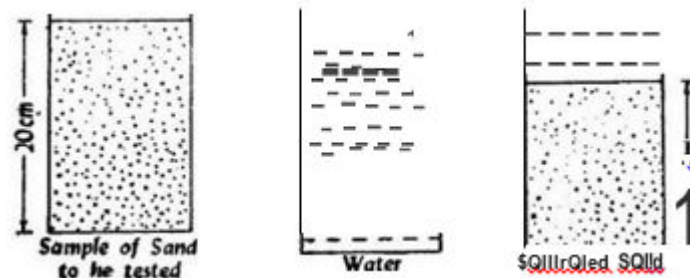
Test for Deleterious materials in sand: Sand shall not contain any harmful impurities such as iron, pyrites, alkalis, salts, coal or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shale in such form or in such quantities as to affect adversely the hardening, strength or durability of the mortar.

The maximum quantities of clay, fine silt, fine dust and organic impurities in the sand / marble dust shall not exceed the following limits:

Clay, fine silt and finedust when determined in accordance within not more than 5% by mass in JS 2386 (Part-m, natural sand or crushed gravel sand and crushed stone sand.

Organic impurities when determined in colour of the liquid shall be lighter in lighter in accordance with IS 2386 (Part - m than that specified in the code.

Test for Bulking of sand



Fine aggregate, when dry or saturated, has almost the same volume but dampness causes increase in volume. In case fine aggregate is damp at the Lime of proportioning the ingredients for mortar or concrete, its quantity shall be increased suitably 10 allow for bulk age.

CONCRETE:

Workability Test (Slump Cone Test): This test is performed to check the consistency of freshly made concrete. The slump test is done to make sure a concrete mix is workable. The measured slump must be within a set range, or tolerance, from the target slump.

STEPS:

- The concrete is collected using a trolley.
- Oil is applied before pouring concrete in the slump cone.
- The slump cone is filled in three layers.
- After every layer, tamping is done for 25 times.
- The cone is removed after filling till the top.
- The slump is checked using the tamping rod.

Compressive Test: The compression test shows the compressive strength of hardened concrete. The compression test shows the best possible strength concrete can reach in perfect conditions. The compression test measures concrete strength in the hardened state. The strength is measured in Mega Pascal's (MPa) and is commonly specified as a characteristic strength of concrete measured at 28 days after mixing. The compressive strength of concrete is a measure of the concrete's ability to resist loads which tend to crush it.

STEPS

- The mould is prepared and oiled.
- The concrete is collected from the batching plant.
- The cubes are filled in three layers.
- Each layer is compacted 35 times using tamping rod.
- The cubes are then kept in curing tank for 7 days and 28 days respectively.
- The cubes are then tested using compression testing machine after 7 and 28 days of curing respectively.

- The cubes attain 67% of their total strength at the end of 7 days and 100% strength after 28 days

Data Analysis

Cost analysis of RCC work Slab

We calculate cost of slab for a span of 15m*8m of total plan area by

considering grade of concrete M20 & thickness of slab 150mm. Grade of concrete M20 (I: 1.5: 3)

Volume of slab = 15*8*0.15 = 18 cum (wet volume) As we know, Dry volume is 54% more than wet volume. Hence,

Dry volume = 1.54*18 = 27.72 cum

Quantity of Cement:

Cement = $1/5.5 * 27.72 = 5.04$ cum

To get quantity of cement in kg we multiply it by its density 1440 kg/cum

Cement in kg = $5.04 * 1440 = 7257.6$ kg Cement bags = $7257.6 / 50 = 145$ bags

Quantity of SAND:

Sand quantity = $1.5/5.5 * 27.72 = 7.56$ cum Quantity of AGGREGATE:

Aggregate quantity = $3/5.5 * 27.72 = 15.12$ cum Quantity of STEEL:

Steel quantity = $1/100 * 15 = 0.15$ cum Steel in kg = $7850 * 0.15 = 1177.5$ kg

Quantity of SHUTTERING: 15*8 = 120 Sqm

Brickwork

We have our hall of size 18ft*12ft and wall thickness is 230mm for calculation of brickwork we have to convert this into cubic meter. i.e., 14 cum

Cement mortar I:4 for 14 cum (walls are 230mm)

Volume of 1 brick with mortar = $0.200 * 0.100 * 0.100 = 0.002$ cum No. of bricks with mortar in 14 cum

= $14 / 0.002 = 7000$ no.

V of 7000 no. of bricks (w.m) = $7000 * 0.001539 = 10.773$ cum

V. of mortar for 14 cum work = $14 - 10.773 = 3.227$ cum For dry v. of mortar = $1.33 * 3.227 = 4.3$ cum

Hence,

Quantity of CEMENT = $1/5 * 4.3 = 0.86$ cum (1140 kg) no. of bags = 30 bags

quantity of SAND = $4/5 * 4.3 = 3.44$ cum

Material	Unit	Quantity	Rate	Amount
brick	No.	7000	10/per no.	70000.00
Cement	Bag	30	380/Bag	11400.00
Sand	Cum	4	450/Cum	1800.00
Labor	No.	3	350/day	1050.00
Total				84250.00

Plaster work

Plastering work is carried out on all the brickwork surfaces of our hall Plastering work is in cement mortar (I:6).

Thickness of plaster is 12mm & area of wall is = 60 sqm. Volume of plaster = area * thickness = $60 * 0.012 = 0.72$ cum Dry

volume of plaster = $1.33 * 0.72 = 0.96$ cum

Quantity of CEMENT = $1/7 * 0.96 = 0.137$ cum Weight of cement = $0.137 * 1440 = 197.28$ kg

No. of bags = 4 bags

Quantity of SAND = $6/7 * 0.4 = 0.343$ cum

Column

Type of construction	Slab	Brickwork	Plastering	Column	Total
RCC	1/8000	84250	2600	33500	298000

Hence total cost in RCC work for making slab of area 15m*8m is 1,78,000rs
 Column size: 230*450mm & floor to floor height is 3m Total column cost = concrete cost+ steel cost + labour we have M20 grade (1:1.5:3)
 Total volume of 1 column= 0.23*0.45*3= 0.32 cum. Quantity of CEMENT= 1/5.5*0.50 = 0.10
 Weight of cement = 0.10*1440 = 144kg
 Hence no. of bags required for 1 column work = 3 bags Quantity of SAND = 1/5.5*0.50= 0.4 cum
 Quantity of AGGREGATE= 3/5.5*0.50= 0.3 cum Quantity of STEEL= (8 Bars of 16mm dia.) Cutting length= 2900+225+225-(2*2(16)) =3286mm
 Hence for weight of steel= (16*16)*3.336/162.2 = 5.28kg Hence for 8 no. its weight = **48 kg**
 Stirrups= 2(130+350)+160-(2*8)*5 = 1040mm
 Hence for 20 stirrup= 0.666*20= **10kg**
 Hence total amount of steel used in one column = 58kg
Hence cost of one column is 6700rs.
Hence total cost of 5 columns in our work = 33500rs
Total cost of RCC work

From the above calculation of all the quantities we calculate all the quantities of RCC work including building materials and Jabour charges & found out the total cost required.

Precast hollow wall panels

For room size of area 18*12ft, 20 precast hollow wall panels are used of size 3*9ft, which accounts area of 27sqft.

Rate of hollow precast wall per sqft is 100rs sqft. Hence rate of one precast wall is 2700rs.

For our room size total cost of all precast wall is 54000rs.

For this project 3 workers are working for 5 days 10 prepare wall units, rate of labour per day = 300/ day

Hence labour charges= 3*5*300= 4500rs Transportation cost for 100 km= 100*25 = 2500rs Crane handling charges= rs*1200=6000rs Hence, **labour+ transportation+ crane= 13000rs Hence total cost for precast walls is 67000rs**

Requirement of Worker & Machinery	Less labours are required. Skilled labours are required at construction site. Skilled and technical contractor is required for construction of the concrete structure . Precast concrete requires heavy machinery and cranes for handling i.e. lifting and installation of heavy elements	More labours are required. Skilled labours are required at construction site . Local contractors can also build the structure. Cast-in-situ concrete does not require such handling equipment.
Strength	Precast concrete construction is quick as it can be installed immediately and there is no waiting for 10 gain strength. Increase in strength can be by accelerated Curing . On site strength test is not required. High strength concrete can be used because it is in controlled condition.	Construction is slow as gaining of strength requires time. Increase in strength at site by accelerated curing is a difficult task. On site strength test is required. It will be difficult to use high strength concrete as it depends on site condition and resources

Time of Construction	Total construction time is less as compared to cast-in-situ. Speedy construction is possible.	Total construction time is more as compared to precast. Speed is less as elements are casted at site.
Surface Finishing	precast concrete gives smooth interior finish hence they need minimum preparation before paint, wallpaper etc. or the other wall coverings can be applied directly.	you have to do plaster for the smooth finish and also requires pre-preparation for a paint like wall putty etc.
points to Be Taken Care of	One has to be meticulous during work with precast concrete because the precast unit can be damaged during transportation and handling.	In the cast-in-situ concrete construction, be careful about following points: 01. During the concreting process like

It not only speeds up the construction work but also enhances quality of final output. It helps in time saving upto 64% compare to nonnal construction methods.

Compared to cast in situ, the following savings can be expected Formwork 75% less

Scaffolding 75% to 90% less Wet concrete 90% less.

Factory production ensures increased accuracy and quality of finish and decreases weather dependency. Compared with cast in situ structures, site labor is reduced by between 50% and 80% using precast.

REFERENCES

- 1]. T Subramani, R. salhiyaraj, C.M.Harish. A.Ashwin, A.N.Nai2am " Vol 7, Issue 2, March 2018 (DETICS)" "Design and Analysis of prefabricated structure using E-Tab"
- 2]. M.Harish, J.D.Chaitanya Kumar,"Vol-8, Issue!, Jan 2017 (DCIET) " Analysis of multi Storey Building with Precast load bearing walls with and without openings•"
- 3]. Akash Lanke, Dr.D.Venkateswarlu,"Vol 3 issue 6june 2016 (JRJET)", "Design,cost & time analysis of precast & RCC building"
- 4]. Vakas K. Rahman, prof. A.R.Mundhada," Vol 3 issue 3 may 2013 (IJMER)", "Comparative study of RCC and prestressed concrete slab slab"
- 5]. Lovneesh Sharma, Nileshwar Taak, Pankaj Mishra "A Comparative study between the pre-engineered structures and conventional structures using STAADPRO", March 2022, 001:10.1016/j.matpr.2020.12.942,
- 6].Jasim Anamaneadan, J. Visuvasam, Anoj Kumar Dubey, Comparative Study on Various Behaviours of an RC Structure with Pre-stressed Concrete Structure", January.
- 7].Hari Prasad M "Comparative Study between Precast and Cast In-Situ Structure Under Combination of Dynamic Loads and Connections between Precast Elements", DSRD International Journal for Scientific Research & Development! Vol. 4, Issue 04, 2016 ISSN (online): 2321-06.



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details