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"COMPARATIVE STUDY OF CONSTRUCTION COST & TIME OF RCC & PRECAST METHODS"

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Abstract— Traditional cast in situ method of building are used in majority of construction projects in India. In India, there is still a significant demand for residential building. As a result, construction must proceed at a faster pace. This is impossible to create using traditional construction methods.
It is possible to accomplish by using precast concrete construction. Furthermore, precast concrete construction have 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 the building adds a new dimension to civil engineering and expands potential in the country's construction industry, 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

1. INTRODUCTION

1.1 General 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 tailors, 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 mould 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.

What is Cost?

Expense incurred by a contractor for labour, material, equipment, financing, service utilities etc. plus overheads and contractors' profit. Cost of land, architectural design, fee of consultant and engineer are not construction costs.
Types of cost Fixed Costs

Fixed costs: are those that do not change throughout the life-cycle of a project. For example, if construction of road is there, the excavators and bulldozers are fixed costs. For software development projects, the physical development space and development computers are fixed costs to the project.

Direct Costs: Direct costs are expenses that come out of the project budget directly. For example, if outsourcing some of the development work, the developers are expected to put in a specific amount of time, which is then billed for. The developer salaries are direct costs.

Sunk Costs: Sunk costs are those that have been incurred in a project, but have not produced value towards the project's objectives.

Factors Affecting Construction Cost

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

Similar Construction Projects: For the construction estimate, the best reference will be similar construction projects. The final cost of those similar projects can give the idea for the new construction project cost calculation. The final cost of past project needs to be factored with current construction cost indices.

Construction Material Costs: Construction material cost consists of material cost, shipping charges and taxes applicable if any. So, it is important consider all these variations while calculating construction material cost.

Labor Wage Rates: Labor wages varies place to place. So, local wage rate should be considered in calculation. If the project has to be started after several months of estimating the project cost, the probable variation in wage rates has to be considered in the calculation.

Construction Site Conditions: Project site conditions can increase construction costs. Site conditions such as poor soil conditions, wetlands, contaminated materials, conflicting utilities (buried pipe, cables, overhead lines, etc.), environmentally sensitivity area, ground water, river or stream crossings, heavy traffic, buried storage tanks, archaeological sites, endangered species habitat and similar existing conditions etc. can increase the project cost during construction phase if these variations are not considered during estimation.

Inflation Factor: A construction project can continue for years before completion. During the construction period, the cost of materials, tools, labors, equipment etc. may vary from time to time. This variation in the prices should be considered during cost estimation process.

Project Schedule: Duration of construction project is affects the cost. Increase in project duration can increase the construction project cost due to increase in indirect costs, while reduction in construction cost also increases the project cost due to increase in direct costs. Therefore, construction project schedules also need to be considered during project cost estimation.

Quality of Plans & Specifications: A good quality construction plans and specifications reduce the construction time by proper execution at site without delay. Any vague wording or poorly drawn plan not only causes confusion, but places doubt in the contractor's mind which generally results in a higher construction cost.

Insurance Requirements: Cost estimation for construction projects should also need to consider costs of insurance for various tools, equipment, construction workers etc. General insurance requirements, such as performance bond, payment bond and contractors general liability are normal costs of construction projects. In some special projects, there can be additional requirements which may have additional costs.

Size and Type of Construction Project: For a large construction project, there can be high demand for workforce. For such a requirement, local workmen may not be sufficient and workmen from different regions need be called. These may incur extra costs such projects and also for the type of construction project where specialized workforce is required.

Location of Construction: When a location of construction project is far away from available resources, it increases the project cost. Cost of transportation for workmen, equipment, materials, tools etc. increases with distance and adds to the project cost.

Engineering Review: Sometimes it is necessary to carry out technical review of construction project to make sure the project will serve the required purpose with optimum operational and maintenance cost. This review cost shall also be added to the project cost.

Contingency: It is always advisable to add at least 10% contingency towards the total project costs for unforeseen costs and inflation

1.2 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 during Covid-19."

1.4 Scope for Construction

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 cr. 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. The main limitation of precast is transportation from place of manufacturing to place of site where it is to be fixed.

1.5 Aims and Objectives

- To study application of Precast Construction technology for executing construction projects like housing, commercial, institutional buildings etc.
- To find different component and connection of precast technology to reduce time and cost
- Comparing various aspects of RCC and precast construction in respect of feasibility, cost & time. And bring down the cost to 25-30% as compare to rcc.
- To prepare general guideline to execute residential building using precast construction technology

2.METHODOLOGY

By operating advance technology at construction project reduce cost and time in transporting of material and increase efficiency of work that ultimately reflect of time and cost.
From literature found that because of frequent change of project managers, Appointment of staffs in the site who are not experienced and also Non sequential progress of works and that Work was not followed as per procedure instead it was followed as per availability of resources caused delays in construction project on pandemic situation
Unavailability of adequately trained health workers and lack of experience in managing an unprecedented emergency; the pandemic and the confinement measures created a psychosocial burden for the population and, especially, the wellbeing of the health workforce.
The construction industry is the vehicle through which physical development is achieved, and this is truly the locomotive of the national economy. The more resources, engineering know-how, labor, materials, equipment, capital, and market exchange provided from within the national economy, the higher the extent of self- reliance. The increasing complexity of infrastructure projects and the environment, within which they are constructed, place greater demands on construction managers to deliver projects on time, within the planned budget and with high quality.
It also aims to identify the main factors that lead to project delays and to suggest recommendations on how to overcome or mitigate effects of the problem. Data is gathered from responses from questionnaire survey and interviews with those involved in construction project.

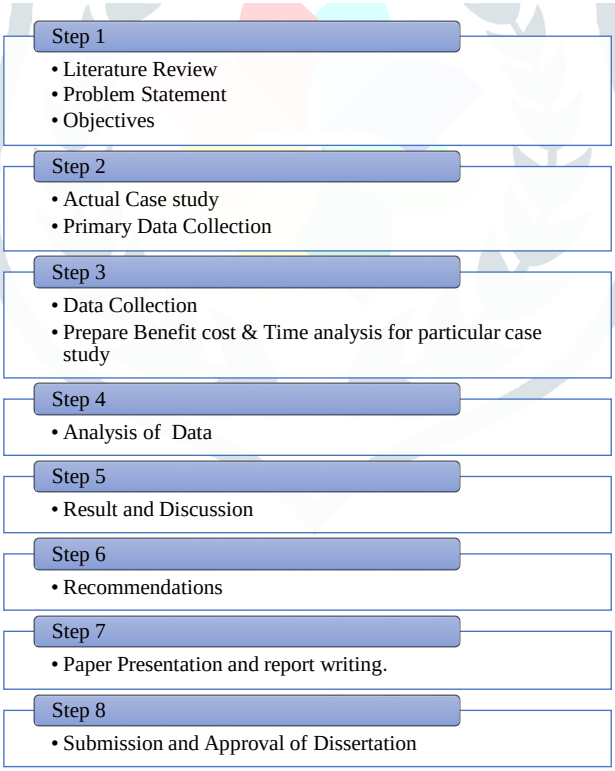


Figure1.1: Methodology chart

3. CASE STUDY

Project Detailed:

Structure Type: Commercial, Residential Building Construction
Name of the project: 38 Park majestic, Undri
Name of the builder: Samrat Buildcon Pvt. Ltd.
Date of Commencement: November 2027

Completion period: 48 Months
Construction Type: RCC Frame Structure & precast construction.
Location: Moshi, Dehu Road
No. of Floor: G+18 Commercial, And Town Ship (G+22) and Bungalow Plots
Total Area of Building: 5, 00000Sq.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 STRUCTUAL CONSULTANT PVT. LTD.

Work Sequence in RCC:

- Soil investigation
- Area grading along with level charts
- Line out
- 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)
- Line out, 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.
- Chasing and fixing of electrical sunken boxes and holes for out let 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 nahni 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 tiles and flooring for toilet, Mosaic tiles below wooden floor.
- Flooring and skirting for the rooms along with acid wash, covering of floor tiles with Dura sheet.
- Internal Electrical wiring work.
- First coat of internal paint, fixing of switches & switch boards with electrical point testing.
- Fixing of door shutters, fixtures, fittings and first coat of polishing to veneer door shutter. Fixing of al sliding doors, windows.
- Modular kitchen work/AC unit fixing work
- Fixing of cap and sanitary wares along with pressure test, fixing of Geyser/Boiler.
- Toilet false celling 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 al windows, doors, kitchen sink, wash basin, cupboard, and bath tubs

EXECUTION

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

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

Formwork (Shuttering)

Formwork (shuttering) in concrete construction is used as a mould for a structure in which fresh concrete is poured only to harden subsequently. Types of concrete formwork construction depend on formwork material and type of structural element

Material Used

Shuttering Clamp: Camp (Shikanja) tool is generally used to hold the shuttering material properly. It is made of mild steel. It has a length=970mm with width=25mm and is thickness=4.5mm

Tie Rod: It is generally used for holding to surface face to face. It is an assembly of a rod with two clamping bolts.

Brackets: Made of mild steel with a base size of 450mm and height of 830mm.It is used at corner to hold form in perpendicular direction

U Jack: They are used to support the bottom of the scaffolding and are attached to the pole where there is provision of changing its length

DOKA TIMBER BEAMS: They are well seasoned beam which can be used for more number of cycle then of conventional timber beams. They have effective protection against moisture and UV radiametertion, as beam-ends are sealed around web.

CUP-LOCK SYSTEM: Cup-lock galvanized scaffold system. It is a well proven heavy duty support system. Which is relatively light and easy to assemble? It is as multi- purpose system, suitable not only for false work support but access as well, and is particularly suitable for building and civil engineering projects.

SHUTTERING OIL: Shuttering oil is applied on the shuttering materials before starting the concreting to prevent adhesion between the concrete and the shuttering material. This helps in easy removal of the shuttering materials after the casting of a member is done.

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 to 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 shikanja
- 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.

REINFORCEMENT

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%

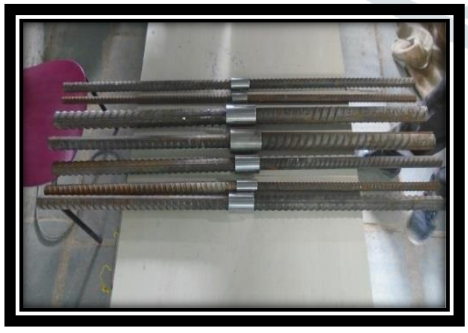
MATERIALS USED IN REINFORCEMENT

- **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.

COUPLER

It is used for binding two bars vertically. Couplers of 8mm, 10mm, 12mm, 16mm, 20mm, 25mm, 32mm diameter meter are available.



COVER BLOCKS

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

Steps For Making Cover Blocks on Site

The mortar is prepared in the ratio of 1:2 (cement: sand)
Diesel is applied on the mould.
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 the mould.
The cover blocks are then 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 to width is more than 2. The slab is supported at two parallel sides where main reinforcement will be placed.

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 to width is less than 2

Main Bars and Distribution Bars

Main bars are provided at the bottom of the slab. The purpose of the main bar is to transfer the bending load developed at the bottom of the slab to the beams. Main bars are placed along the shorter span. The distribution bars are placed on the top of the main bars. It is placed along the longer span. Lesser diameter bars are used as distribution bars since it is only to resist the cracks developed due to shear stress on top of the slab.

REINFORCEMENT FOR COLUMN

STEPS

- Reinforcement
- Check Column Reduction Face & Bar Spacing as Per Stirrups Details
- Arrangement, Diameter & Spacing of Stirrups As per Details
- Check for Stirrups Hook Distance & Angle

STAGGERED REINFORCEMENT: It 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 to 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.

Learnings and Contributions

Documentation & Reports Preparation

- Preparation of Daily Progress Report
- Preparation of Weekly Status Report
- Preparation of Monthly Progress Report

Project Planning

Planned Vs. Actuals
Reasons For Delays
Use six sigma analysis to solve problem occurs during execution
Preparation of Micro-Level schedule to Master Schedule

For Slab Cycles (17 Days)
Daily Monitoring

Site Inspections

Quality Inspections (Columns, Beams, Slabs and Shear Walls)
Reinforcement checks at Slabs, Beams, Columns and Shear Walls
Preparation of Quality Issues Reports
Block Work and Plastering Inspections
Column Verticality Inspections.

Estimation and Quantity Surveying

Estimated the quantity of Shuttering and Formwork required for Beams,
Slabs, Shear Walls and Columns
Estimated Quantity of Concrete required for Beam, Column, Shear wall and Slab casting
Estimated Flooring Quantities (Tiles) for Amenities Block and Block
Calculated the quantities required for Cladding with appropriate classification (Living Room, Halls, Bed Rooms, Toilets, and Washrooms etc.)

Analyzing Various Drawings

Structural Drawings
Architectural Drawings
Services Drawings
Landscaping Drawings

Implementation of Precast Elements

The procedure for casting concrete shall be as follows:

1. Precast concrete elements shall be produced on horizontal, flat steel surfaced tilting tables,Side shutter are fixed in position.
2. Apply mould release agents to sides and bottom.
3. Steel reinforcement shall be kept in position using adequate spacers to ensure correct position and concrete cover.Prior to casting, electrical conduits, plumbing grooves and sleeves, and other required accessories like lifting anchors, loop boxes and dowel tubes shall be fixed in position.
4. The high-quality concrete shall be transported from batching plant to the precast bay moulds through concrete distributions ystem of flying bucket, discharge chutes, distribution bucket and EOT cranes.
5. During casting, table vibrators (as & when required) shall be used to achieve the best compaction. Top surface shall be finished with hand operated trowel which gives smooth finish. Care should be taken on embedded items while concreting. After casting, Casted elements shall be de-moulded once the strength meets the design requirements and the units are then shifted to the stockyard. Thereafter, curing shall be carried out for minimum 5 days.

Curing

1. The curing of the prefabricated elements may be done by the normal methods of curing by sprinkling water and keeping the elements moist.
2. De-moulding and Stacking
3. Lifting of elements from mould
4. It must be ensured that all the elements should have identification mark.
5. It must be ensured that all side shutters are loosened so that the elements may be lifted without any damages.
6. Before demoulding, it must be ensured that compressive strength of the cubes should meet the specified requirements.
7. The lifting clamps/clutches shall be fixed to lifting beam at proper positions.
6. Then the elements shall be lifted carefully to the stocking area

Stacking of elements

1. The surface of stacking area should be horizontal.
2. Number of the elements per lot should not exceed man height.
3. In case of vertical stacking, the gap between the elements should be 150 mm to 200 mm.
4. Stacking shall be done in such a way that slabs of longer span should be placed below that of shorter span.

Transportation of Elements

1. The process of transportation of precast elements from yard to site shall be as follows:
2. Loading of slab over trailer
3. It must be ensured that the identification mark on the slab should be the same as per dispatch list.
4. Any damage occurred during loading should be informed to the concerned authority.
5. The lifting clamps/clutches shall be fixed to the lifting beam at proper position.
6. The lifting beam shall be placed over the precast elements and ensured that the clutches are locked properly before lifting.
7. Instruction regarding loading height, positioning of
8. precast elements over the trailer should be followed as per capacity of trailer.
9. The wooden rubber shall be placed in between the slabs at 500 mm from each end. Some of precast elements should be placed vertically and transported through a frame fixed vehicle.
10. The slab shall not be overhanging from trailer.
11. The slab shall be tied firmly to the trailer by means of belt/rope as moving the load without proper tie will cause damage.
12. While transporting elements vertically, the vehicle should
13. be loaded equally on both sides.

Unloading of slab from trailer and placing in site

1. Every slab shall be inspected for dimensions / identification mark and damages etc. prior to unloading at site.
2. The stacking area should be leveled and hard enough for stacking the elements.
3. There should be proper access for trailer movement.

Erection

The process of erection and installation of panels during construction cycle by using tower cranes shall be as follows:

1. Before starting erection a survey of the area to receive precast elements shall be done to monitor any difference in dimensions or levels exceeding the tolerances. In case of unacceptable tolerances, necessary action shall be taken for rectification. Installation shall be done by tower crane with sufficient capacity. Panels shall be shifted from the truck from yard to the nearest point of construction site and shall be kept above the truck during the construction or inside the storage racks as per the site situation.
2. The necessary access for the truck to reach the nearest point of the tower shall be prepared before starting erection of the panels.
3. Once the truck reaches the tower, chain and lifting clutch with required capacity and guide rope shall be attached to the precast panels to allow the workers to control the load to its final place.
4. The gap between the element and adjusted elements shall be maintained as per the drawings within the allowable tolerances.
5. Temporary propping jacks shall be provided for restraining the walls laterally until grouting.
6. After completion of fixing, alignment of the panels shall be
7. checked again.
8. Minor damages, if any to the precast panels shall be repaired by approved materials.
9. After completion of installation and alignment, elements shall be handed over for inspection.
10. The joints between the precast wall panels shall be filled with joint filler material.
11. Precast slab shall be erected above the wall panels without any scaffolding system. The electrical conduit/fitting shall be done.

12. After electrical works are completed, screed concrete shall be laid over the precast slab.
13. Installation of the next floor shall start only after completion of screed concrete of the previous floor.

Installation of vertical components

1. Verification of delivered panels Verifies that the delivered panels have the correct lifting hook and position, etc.
2. Surface finish condition Prefabricated Dimension Compliance Reinforcement position compliance with architectural details Setting Check the panels delivered by markings, lifting hook and condition.
3. Lift and place the panel in the designated location Adjust the panel in position and secure elevation of space by adding elements with a balanced center of gravity.
4. Ensure correct horizontal alignment
5. The panels vertically to correct the plumb line to check the consistency of the space between panels checks the stability of the strut before releasing the lifting cable.

Groundwork

Apply mortars without shrinkage to seal Patented grouts in pipe slabs. Keep the panels installed without discomfort for 24 hours. Verify that joint widths are consistent before grouting grout used must be of the same degree of components and self-compacting to avoid cracks Collect a sample of test cube to test critical elements or load-bearing elements that join joints on-site cast joints install reinforcing bars as necessary configure shapes to melt together make concrete remove shapes after sufficient resistance external connections sealant will be user panel with welded connections welding as the required installation process.

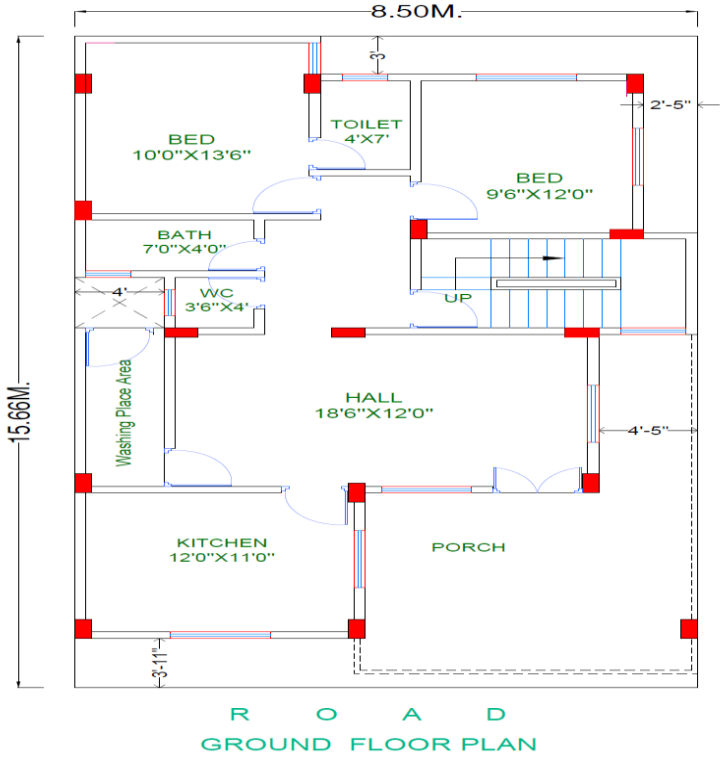
Installation of horizontal elements

settings the reference line/compensation line at the required alignment and slab/beam level during installation put temporary support to support the precast slab/beam elements before lifting quim.
Dimensions Check the level and stability of the wedge Verify that the protruding/initial bars are within the specified tolerance to avoid any observation during the assembly process
Lifting & installation
Temporary accessories to support the slab/beam Lift and mount the items at the designated location align and verify the level before placement teams must prop up at least two locations.

Joining elements

Prefabricated with cast iron joints in situ position reinforcement bars as necessary establish a way of working to melt together remove formwork after achieving concrete strength. The support beams will be designed to be part of the work joints.

4.Data Analysis



Cost analysis of RCC work

Slab

We calculate cost of slab for a span of 18'6" *12' of total plan area by considering grade of concrete M20 & thickness of slab 150mm.

Grade of concreter M20 (1: 1.5: 3)

Volume of slab= 6.5*4*0.150m= 4cum (wet volume)

As we know, Dry volume is 54% more than wet volume.

Hence, Dry volume = 1.54*4= 7cum

Quantity of CEMENT:

Cement = 1/5.5 *7= 2cum

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

Cement in kg =2*1440=2900kg

Cement bags = 2900/50= 60 bags

Quantity of SAND:

Sand quantity= 1.5/5.5 *7 = 2cum

Quantity of AGGREGATE:

Aggregate quantity = 3/5.5*7=3.8cum

Quantity of STEEL:

Steel quantity = 1/100*4= 0.04cum

Steel in kg= 7850*0.04=315kg

Quantity of SHUTTERING: 6.2*4= 25Sqm

Hence total cost in RCC work for making slab of area 6.5m*4m is 70,000rs

Material	Unit	Quantity	Rate	Ammount
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

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,14cum

Cement mortar 1:4 for 14cum (walls are 230mm)

Volume of 1 brick with mortar=0.200*0.100*0.100=0.002cum

No. of bricks with mortar in 14 cum =14/0.002=7000no.

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

V. of mortar for 14cum work=14-10.773=3.227cum

For dry v. of mortar = 1.33*3.227=5cum

Hence,

Quantity of CEMENT = 1/5*5= 1cum (1140 kg)

no. of bags = 30 bags

quantity of SAND = 4/5*5= 4 cum

Material	**Unit**	**Quantity**	**Rate**	**Amount**
Cement	Bag	4	380/Bag	1520.00
Sand	Cum	0.3	1200/Cum	1080.00
Total				2600.00

Plaster work

Plastering work is carried out on all the brickwork surfaces of our hall Plastering work is in cement mortar (1:6).

Thickness of plaster is 12mm &area of wall is =60sqm.

Volume of plaster = area * thickness = 60*0.012=0.72cum

Dry volume of plaster = 1.33*0.72 = 0.96cum

Quantity of CEMENT = 1/7*0.96= 0.13cum

Weight if cement = 0.13*1440= 188kg

No. of bags = 4bags

Quantity of SAND = 6/7*0.4= 0.9cum

Material	**Unit**	**Quantity**	**Rate**	**Amount**
Cement	Bag	3	380/Bag	1140.00
Sand	Cum	0.4	450/Cum	180.00
Aggregate	Cum	0.3	550/Cum	165.00
Steel	Kg	58	70/Kg	4060.00
Shttering	Sqm	0.2	300/Sqm	60.00
Labor	No.	3	350	1050.00
Total				6700.00

Column

Column size: 230*450mm & floor to floor height is 3m

Total column cost = concrete cost+ steel cost + labour cost

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

Materials	Unit	Quantity	Rate	Ammount
Cement	Bag	60	380/Bag	23000.00
Sand	Cum	2	450/Cum	900.00
Aggregate	Cum	3.8	550/Cum	2000.00
Steel	Kg	315	70/Kg	25000.00
Shttering	Sqm	25	300/Sqm	8000.00
Labor	No.	4	350	1400.00
Total				70,000.00

Hence cost of one column is 6700rs.

Hence total cost of 5 columns in our work = 33500rs

= 1040mm

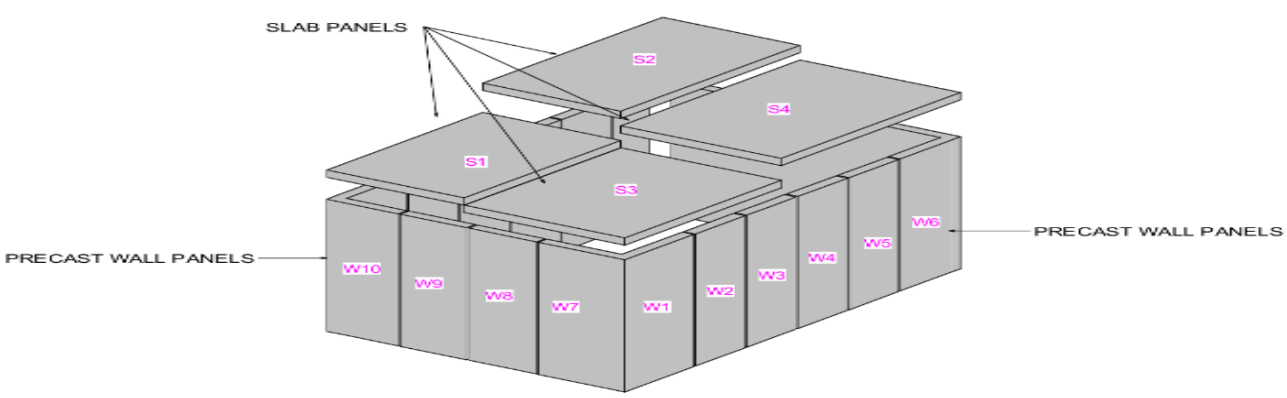
Hence for 20 stirrup = 0.666*20= 10kg
Hence total amount of steel used in one column = 58kg

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 labour charges & found out the total cost required :

Type of construction	Slab	Brickwork	Plastering	Column	Total
RCC	70000.00	84250.00	2600.00	33500.00	1,90,000.00

Cost analysis of precast work



Precast slab

Total area covered for precast slab units = 18'6"*12'=225sqft
Rate of solid precast slab (125mm) per sqft = 200rs/sqft
For this construction project 4 precast slabs are used . Size of each precast slab unit is 6ft*9ft .
Hence for 4 slab units (6*9ft=54sqft) i.e, for 225 sqft area we can calculate cost required for this area is 225sqft*200rs = 45,000rs

Size of each precast slab	No. of units	Rate of each unit	Total
6*9ft	4	200rs/unit	45,000.00

For this project 3 workers are working for 5 days to prepare slab units , rate of labour per day = 350/ day
Hence labour charges = 3*5*350= 5500rs
Transportation cost for 100 km(25rs/km)= 100*25 = 2500rs
Crane handling charges = 5hrs*1300= 6500rs
Hence, **labour+ transportation + crane = 13000rs**
Hence total cost for making precast slab is 158000rs

Type of structure	Activities	Total cost of slab
RCC	Per unit + shuttering + labour	70,000.00
Precast	Unit making + transportation + erection	60,000.00

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 140rs sqft. hence rate of one precast wall is 3800rs.
For our room size total cost of all precast wall is 76000rs.
For this project 3 workers are working for 5 days to prepare wall units, rate of labour per day = 350/ day
Hence labour charges = 3*5*350= 5500rs
Transportation cost for 100 km= 100*25 = 2500rs
Crane handling charges = 5hrs*1200=6500rs
Hence, **labour+ transportation + crane = 13000rs**
Hence total cost for precast walls is 91000rs

Cost differentiation

From above calculations of precast & RCC construction we find the cost differentiation in both of the system:
RCC work:

Type of construction	Slab	Brickwork	Plastering work	column	Total
RCC	70,000	84250	2600	33500	2,00,000.00

Precast work:

Type of construction	Precast slab	Precast wall panels	Total
Precast	60,000	91,000	1,51,000.00

Hence we can find that for our construction the cost difference is found to be 50,000.00rs
Hence we can say there is cost saving of 28% in precast construction as compare to RCC.

Time difference

RCC:

1.column:

Day 1: Marking of columns & making of columns reinforcement of required size
Day 2: installation of column formwork of required size
Day 3: filling of column formwork with concrete of suitable design mix as mentioned in Design
Day 4: de-shuttering of column formwork & starting curing process. curing should be done For 24 days for column to achieve concrete its desired strength

2.Beam & slab

Day 6: installation of shuttering for beam & slab .and parallelly making Reinforcement.
Day 7: placing of beam reinforcement & slab reinforcement as per detailed design & drawing Making suitable electric work while placing of slab reinforcement.
Day 8: concreting work is done in beam & slab.
Day 9: starting of curing for slab & beam. It should be done for 24 days.
Day 28: de-shuttering of slab members, removing bottom shuttering of slab.
Day 29 to day 32: starting & completion of brickwork, masonary work & plastering work.

Precast:

Day 1: Casting of concrete
a) Fixing Side shutter
b) Applying mould
c) Placing of Steel reinforcement
d) Use of table vibrators
Day 4: Demoulding of casted elements in factory
Day 5: curing of elements. Steam curing is used in factory which hardly takes 16-20 hours.

Day 7: storing of precast elements in factory by giving proper numbers to slab & wall panels.
Day 8: transportation of ready prefabricated elements as per site requirements. And storing Those elements on site.
Day 9: installation of all wall panels & slab panel at required position as per detailed design And drawing .
Day 10: After completion of fixing, alignment of the panels shall be checked again. Minor damages, if any to the precast panels shall be repaired by approved materials.
Day 11: After completion of installation and alignment, elements shall be handed over for Inspection. The joints between the precast wall panels shall be filled with joint filler Material.

Time difference:
Substructure of both the construction system takes the same time. But superstructure time of both the system is different.
Precast construction system takes less time as compare to RCC. RCC construction system requires large amount formwork & curing period this result in gaining more time for RCC construction.

Hence there is time saving of 60% in precast as compare to RCC.

RCC		**Precast**	
Activity	**No. of days**	**Activity**	**No. of days**
Column	1 to 4 days	Making of precast units	1 to 7 days
Beam & Slab	5 to 28 days	Transportation	8th day
Brick masonary work	29 to 32 days	Installation	9th day
		Inspection & joint filling	11th day
Total no. of days	**32 days**		**12 days**

Activity differentiation

Here the few comparisons made with conventional construction system by studying the site work and analysing the activities.

1. Precast construction method is purely based on shear wall concept and hence the typical floor doesn't contain any type of columns but in conventional, columns are must to construct.
2. Precast construction process carried out at site as production of elements along with simultaneous erection of the ready elements which considerably saves the time & there is time saving of 60% as compare to RCC.
3. In conventional, block work and curing consume much time to complete.
   Block work is limited to 1 to 1.2m height per day to maintain proper alignment whereas; Precast elements do not have any such restrictions.
4. In conventional method, block work must proceed further with proper curing and also plastering require curing period for sufficient hydration, but in precast method, no such intense curing required because, the main and final curing done at casting yard only to achieve maximum strength.
5. Plastering work is mandatory in conventional whereas precast method doesn't require any kind of plastering work.
6. For slabs, shuttering work, reinforcement works consume more time in conventional method; but in precast, slabs also get manufactured in yard itself.
7. All parts of a structure cannot be fixed with precast elements; at few necessary locations block work is essential in precast construction also.
8. No alterations in design are possible in precast construction; but in conventional, any kind of alterations are made without any problem.
9. Better quality control can be possible with precast construction but as the floor level increases, in conventional system it is very difficult to maintain good quality.
10. Precast construction system requires almost half the number of total man power that required for conventional system.
11. Construction activities take place at a faster rate in precast compared to conventional system.
12. Precast construction provides better alignment of structural elements than the conventional one.

13. Precast construction is also suitable for large construction projects; whereas conventional system lead to various problems and consumes huge time for completion.

5. CONCLUSION

- ✓ Prefabrication construction technology generates less waste on site because building elements are cast in the warehouse and then transported to the site for final erection and installation.
- ✓ Precast construction system is economical than conventional system & bring down the construction cost by 25-30% as compare to RCC.
- ✓ It not only speed up the construction work but also enhances quality of final output. It helps in time saving upto 60% compare to normal construction methods
- ✓ The sustainability aspects viz. social, economic and environmental may promote prefab technology as a promising alternative in construction industry.
- ✓ Precast technique more essential for construction of rehabilitated villages in India. Cost and time required to complete the project by conventional technique is more than precast technique.
- ✓ If precast technique is used over conventional technique in India it can be very useful and advantageous to solve housing problem. Maximum number of homes with greater quality and in minimum time can be provided by using precast technique than using conventional technique.
- ✓ 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. sathiyaraj, C.M.Harish, A.Ashwin, A.N.Naizam " Vol 7, Issue 2, March 2018 (IJETTCS)" "Design and Analysis of prefabricated structure using E-Tab"

[2]. M.Harish, J.D.Chaitanya Kumar,"Vol-8, Issue1, Jan 2017 (IJCIET) " Analysis of multi Storey Building with Precast load bearing walls with and without openings"

[3]. Akash Lanke, Dr.D.Venkateswarlu,"Vol 3 issue 6 june 2016 (IRJET)","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 flab slab".

[5]. Lovneesh Sharma, Nileshwar Taak, Pankaj Mishra "A Comparative study between the pre-engineered structures and conventional structures using STAADPRO", March 202, DOI:10.1016/j.matpr.2020.12.942,

[6]. Jasim Anamangadan, J. Visuvasam, Anoj Kumar Dubey, "Comparative Study on Various Behaviours of an RC Structure with Pre-stressed Concrete Structure", January 2019, DOI:10.1007/978-981-10-8016-6_27,

[7]. Hari Prasad M "Comparative Study between Precast and Cast In-Situ Structure Under Combination of Dynamic Loads and Connections between Precast Elements", IJSRD - International Journal for Scientific Research & Development| Vol. 4, Issue 04, 2016 | ISSN (online): 2321-0613

[8]. Bhanu Prakash P.M, Dr. Vijaya Kumar Y.M and T A Srirama Rao "Review On Comparative Study On RCC And Steel Structure For Different Criteria's," ISSN:2277-7881; Impact Factor: 6.514(2021); IC Value: 5.16; ISI Value:2.286, International Journal of Multi-displinary Educational Research

[9]. Nagaraju Kaja, Anupam Jauswal "Review of Precast Concrete Technology in India," International Journal of Engineering Research & Technology (IJERT) http://www.ijert.org ISSN: 2278-0181 Published by :www.ijert.org Vol. 10 Issue 06, June-2021

[10]. Umamaheswara Rao Tallapalem, Shaik Nurulla, SrinivasaraoVallu, "Time History Analysis on Precast Building Connections" International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-4, November 2019