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TIME AND COST ANALYSIS OF PRECAST METHOD WITH RESPECT TO CONVENTIONAL METHOD

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Abstract

Housing, basic needs for everyone. Initially mud was used as part of construction. Ancient houses were built of mud and grass. The Romans were in the forefront of construction technology to explore the mixture of lime and stone to build a magnificent structure like the Pantheon which is still the world's largest and most durable concrete dam. The use of precast in construction is nothing new. The ancient Romans used mould to develop their amazing system of processes and canals. With the growing demand for housing, the need for automation and modernity the construction industry was taken over. In the current context, the invention and development of engineering and architecture has enabled the construction world to explore the neo-arena of precast technology. Design and development do not create anything new, but redefine what a modern approach is. The construction industry has pushed the boundaries of a load bearing structure and compliant with housing needs. This allows for reinforced concrete structures with concrete frames to make construction more reliable and faster. We can imagine the future with just the same construction of Lego toys. With Precast, we can think about stability, speed, durability, safety and a bright future for the construction industry.

Keywords: *Precast Technology, high-end residential buildings, Inexpensive construction, staff reduction, rapid construction, controlled production conditions, quality improvement.*

I. INTRODUCTION

Traditional building methods in India need to be developed with modern technology. Familiarity with modern tools and technologies can provide improved quality construction while using less resources such as time, cost, labor, building materials, etc. The use of precast concrete building technology regularly provides effective performance and improved quality over the past fifty years. Developing countries like India need it to fully meet the huge demand for housing, commercial buildings and infrastructure projects. The rapid growth of the urban population has created a huge demand for housing, infrastructure development, and real estate. Ernst & Young and FICCI submitted a report showing a 65% staff shortage by 2021 [1]. GOI has developed a “Housing for All” proposal under the Pradhan Mantri Awash Yojana (PMAY) program. To achieve the intended PMAY-2022, the use of precast technology not only improves the quality of construction but also reduces the duration of the project. It has been noted that the use of PCC is limited to the public sector mainly due to factors such as high initial investment rate, small number of qualified people, local needs, direct and horizontal barrier to module transport, lack of communication data set. in IS codes and precast module verification by BIS. The various components of pre-concrete construction require adequate and systematic planning and design to minimize production errors. The combination of different sections such as slab, beam, and columns requires specific details that help precast structure not only transfer loads but also function as monolithic systems.

External precast modules need to be properly assembled to avoid any moisture and water leakage problems. The use of precast wall panels also gives us an additional thermal benefit.

II. LITERATURE REVIEW

1. P. Karthigai Priya, et al (2018) Most construction projects in India take place in the form of standard letter construction. But there is still a huge need for housing in India. Therefore construction work should be done internally very quickly. Nowadays precast concrete has been widely used in many housing and commercial projects. Because the benefits of precast concrete. It has high durability, high thermal properties and is very easy to handle and more. And the quality of precast concrete is high especially as it is produced under high control. But there is a lack of awareness and information about the previously made concrete in our country.
2. Anisha Mire, et al (2017) As precast members are included in all industries transfer work in factories from the site as a result of which the total amount of construction is less standard system. Production elements such as slab, column, and beam in factory improves quality production and reduces the amount of time required construction as all members connect only to the construction site. Theoreticallythe construction costs of precast technology are higher than cast-in-place technology but actually when we consider the cost of damage and the speed of construction with The cost of building high quality concrete is minimal. The main benefits of Precast concrete technology is high quality, labor costs are low, construction is slow loss and value of cash product.
3. Sayali A. More, et al (2017) The paper is based on an analysis of time, cost, and precast concrete level. As a developing country, the precast fills in the need for the construction industry. Cost depends on time as the cost of construction increases over time and varies depending on the productivity of the project. Ku this paper author is researched by cost, time, quality and precast production concrete. Precast construction requires less time than cast-in-place, and larger quality and mass production. In the process of producing precast concrete level check in each category.
4. Richard Oduro Asamoah et al (2016) In Ghana the construction industry is booming effective in the area of cost and acquisition of advanced or modern technology. Ku construction industry effective cost management of customers, developers and promoters to get the amount of money. The study aims to analyze the cost cost of part of the structure for example, column and slab by separating the installation method and the pre-distributed concrete method. According to the author the research results that prefabricated concrete is 21.4% less than the total cost than locally made concrete. According to a Ghanaian author it is becoming more efficient in the area of cost as well with advanced technology. Effective management can reduce the cost of construction and the same duration that gives the client its indirect value money. This study aims to compare the cost of building precast concrete as well cast cast in place. The front concrete is 23.22% lower than cast in place concrete.
5. C.Sivapriya et al (2016) now the construction industry is replacing their traditional methods to build with a new strategy, using standard, systematic systems. A standard system consisting of Cast-in-place concrete as a pre-broadcast system developed by only collection of precast site members. Forms used in precast can be used in hundreds of time savings on construction costs.

III. METHODOLOGY

The precast structural elements can be broadly divided into two categories based on the production method, namely Solid and Empty Backbone. For standard living space construction of large columns, beams, canopy, wall panels, closures, balcony, stairs, slabs etc. In these columns, beams, canopy, wall panels, closures and balcony, stairs, chairs. slope and slabs are the bare backbone of various types. For me a typical building site has many other pre-installed elements such as lift core, boundary walls, curb stones, etc.

Benefits are provided by precast There are so many benefits associated with the use of precast technology concrete components. That's right these require proper composition, proper use of materials and production processes with skilled and knowledgeable staff. Well-designed and afloat concrete go a long way to reduce and eliminate many common construction problems, while the precast economy translates into faster, less expensive projects.

A. Speed-to-market
B. Quality & durability
C. Integrated project delivery
D. Enhances safety
E. Sustainability
F. Optimization & flexibility

Type of precast system

Depending on the load bearing structure precast systems can be divided into the following categories:

a) Large panel systems
b) Frame systems
c) Slab column systems with wall
d) Mixed system

Precast components

a) Slabs
b) Beam
c) Columns
d) Walls
e) Stairs

Barriers to precast construction in India

a) Investment
b) Space Availability
c) Taxation
d) Transportation
e) Infrastructure
f) Standardization
g) Joints & Connections
h) Perception

IV. CASE STUDY

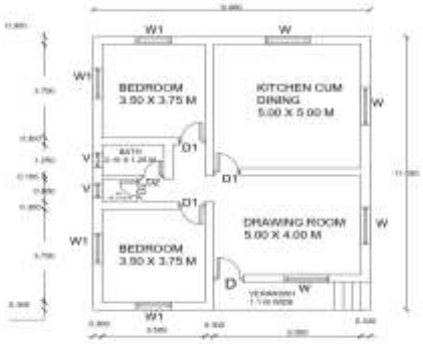


Fig-1 Plan of single story building

A. Cost Analysis

a) By Conventional Method

Table -1: Abstract Sheet

ABSTRACT SHEET						
ITEM NO.	PARTICULARS OF ITEMS	QUANTITY	UNIT	RATE	PER	AMOUNT
1	EARTHWORK IN EXCAVATION IN FOUNDATION NO. OF COLUMNS	23.76	CU.M	434	CU.M	10311.84
2	PCC FOOTING 1:4:8 THICKNESS OF FOOTING	8.68	CU.M	5995.3	CU.M	50806.22
3	CONCRETE IN FOOTING	4.99125	CU.M	7111.1	CU.M	35493.28
4	DPC OF 1:2:4 C.C. 2.5 CM THK. WITH WP. MATERIAL	17.16	SQ.M	450	SQ.M	7722.00
5	RCC COLUMN	4.059	CU.M	13433.1	CU.M	54520.89
6	RCC BEAM	5.481	CU.M	11926.1	CU.M	65377.92
7	RCC PLINTH BEAM	5.481	CU.M	11926.1	CU.M	65377.92
8	1st CLASS B.W. IN SUPERSTRUCTURE IN C.M. 1:6	48.7179	CU.M	8205.53	CU.M	399757.16
9	1st CLASS HALF B.W. IN SUPERSTRUCTURE IN C.M. 1:6 ONLY ONE WALL IS CONSIDERED	4.725	SQ.M	1336.42	SQ.M	6588.08
10	EARTHWORK IN FILLING IN PLINTH	98.28375	CU.M	929.15	CU.M	35571.35
11	BRICKWORK IN PLINTH	8.2215	CU.M	7978.55	CU.M	65595.65
12	RCC CHAJJA M20 GRADE INCLUDING LINTEL	4.5698	CU.M	13356.1	CU.M	58342.74
13	RCC SLAB M20	11.915725	CU.M	14388.1	CU.M	171484.64
14	PLASTERING 12MM THK. WITH C.M. 1:3	277.702	SQ.M	466.6	SQ.M	129575.75
15	20MM PLASTERING WITH C.M. 1:4 EXTERNAL	180.78	SQ.M	615.6	SQ.M	111288.17
16	CEMENT BASED MOZZAIC TILE FLOORING EXCLUDING WC / BATH	81.899	SQ.M	1204.05	SQ.M	98610.49
17	CEMENT BASED MARBEL MOZZAIC TILE SKIRTING	65.09	M	116	M	7550.44
18	FLOOR TILES AND DADO IN WC / BATH	22.779	SQ.M	1276.05	SQ.M	29067.14
19	COLOURING INTERNALLY	277.702	SQ.M	483	SQ.M	134130.07
20	COLOURING EXTERNALLY	180.78	SQ.M	396	SQ.M	71588.88
21	FULLY PANELLED TW DOOR	10.983	SQ.M	3736	SQ.M	41032.49
22	FINISHING TERRACE	11.915725	SQ.M	308.25	SQ.M	3673.02
23	ALLUMINIUM WINDOW	12.96	SQ.M	7137	SQ.M	92236.52
24	M.S GRILL	12.96	SQ.M	5272	SQ.M	68325.12
25	REINFORCEMENT	3677.725	KG	71.97	KG	264685.87
					TOTAL	2078683.46

Above abstract sheet represents the particulars of items with respect to their rates and quantity of single story plan (as mention in fig-1). These shows that the by conventional method total expenditure 20,78,683.46 Rupees.

Note- All rates are taken as per SSR 2020-2021

b) By Precast Method

Table -2: Abstract Sheet

ABSTRACT SHEET						
ITEM NO.	PARTICULARS OF ITEMS	QUANTITY	UNIT	RATE	PER	AMOUNT
1	EARTHWORK IN EXCAVATION IN FOUNDATION NO. OF COLUMNS	23.76	CU.M	434	CU.M	10311.84
2	MOULD /FORMWORK/SHUTTERING	176.2503	CU.M	470.53	CU.M	82931.05
3	RCC WORK	137.385	CU.M	11918.17	CU.M	1637377.79
4	CURING	137.385	CU.M	200	CU.M	27477.00
5	TRANSPORTING	137.385	CU.M	429.07	CU.M	58947.78
6	ASSEMBLING AND FIXING	137.385	CU.M	1276.05	CU.M	175310.13
7	JOINT FILLING BY PCC	137.385	CU.M	1204.5	CU.M	165480.23
8	EARTHWORK IN FILLING IN PLINTH	98.28375	CU.M	929.15	CU.M	35571.35
9	PLASTERING 12MM THK. WITH C.M. 1:3	277.702	SQ.M	466.6	SQ.M	129575.75
10	20MM PLASTERING WITH C.M. 1:4 EXTERNAL	180.78	SQ.M	615.6	SQ.M	111288.17
11	CEMENT BASED MOZZAIC TILE FLOORING EXCLUDING WC / BATH	81.899	SQ.M	1204.05	SQ.M	98610.49
12	CEMENT BASED MARBEL MOZZAIC TILE SKIRTING	65.09	M	116	M	7550.44
13	FLOOR TILES AND DADO IN WC / BATH	22.779	SQ.M	1276.05	SQ.M	29067.14
14	COLOURING INTERNALLY	277.702	SQ.M	483	SQ.M	134130.07
15	COLOURING EXTERNALLY	180.78	SQ.M	396	SQ.M	71588.88
16	FULLY PANELLED TW DOOR	10.983	SQ.M	3736	SQ.M	41032.49
17	FINISHING TERRACE	11.915725	CU.M	308.25	CU.M	3673.02
18	ALLUMINIUM WINDOW	12.96	SQ.M	7117	SQ.M	92236.52
19	M.S GRILL	12.96	SQ.M	5272	SQ.M	68325.12
					TOTAL	2980485.06

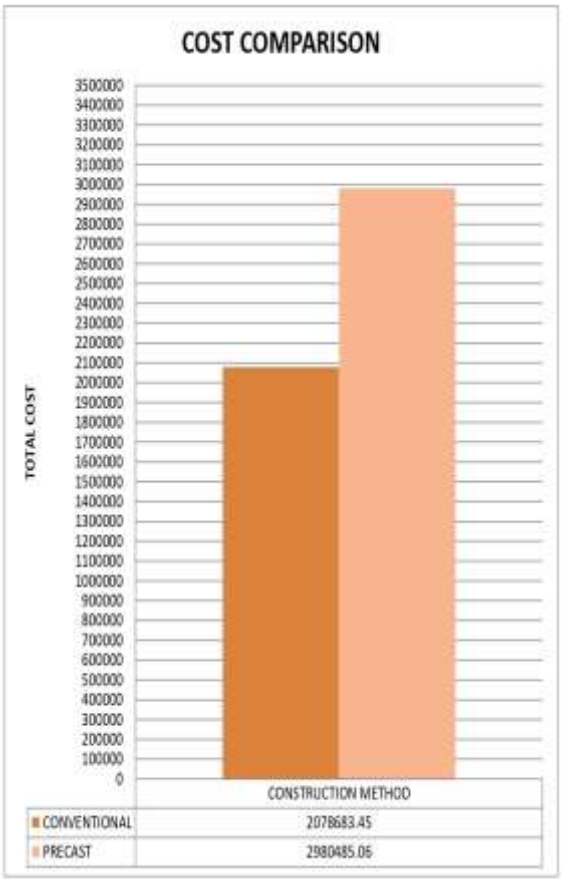
Above abstract sheet represents the particulars of items with respect to their rates and quantity of single story plan (as mention in fig-1). These shows that the by precast method total expenditure 29,80,485.06 Rupees.

Note- All rates are taken as per SSR 2020-2021

c) Cost Comparison

As below chart represent the cost comparison between conventional and precast method the total difference between them is 9,01,801.60 Rupees this represent that for single story building precast method is costlier than conventional method.

Charts - 1



B. Time Analysis

a) By Conventional Method

Table -3: Durations

CONVENTIONALLY CONSTRUCTION DURATION			
SR.NO.	ACTIVITY	DESCRIPTION	DURATION
1	1_2	SURVEY , DESIGN AND LAYOUT	3
2	2_3	CONSTRUCTION OF FOUNDATION	8
3	3_4	CONSTRUCTION OF SUPERSTRUCTURE	15
4	4_5	SLAB	25
5	5_6	FIXING DOOR AND WINDOWS	3
6	5_7	PLUMBING	3
7	5_8	ELECTRIC FITTING	3
8	8_9	PLASTERING	6
9	9_10	FLOORING	4
10	10_11	CARPENTARY WORK	5
11	10_12	OTHER MINOR WORK	3
12	12_13	CLEARING	2
13	13_14	FINISHING OF DOOR AND WINDOWS	3

Table -4: Floated Time Calculation

ACTIVITY	DURATION	EARLIEST TIME		LATEST TIME		FLOAT	REMARK
		E.S.T.	E.F.T.	L.S.T.	L.F.T		
1_2	3	0	3	0	3	0	
2_3	8	3	11	3	11	0	
3_4	15	11	26	11	26	0	
4_5	25	26	51	26	51	0	
5_6	3	51	54	54	57	3	EXTRA FLOAT = 11
5_7	3	51	54	54	57	3	
5_8	3	51	54	57	54	0	
8_9	6	54	60	54	60	0	
9_10	4	60	64	60	64	0	
10_11	5	64	69	69	74	5	
10_12	3	64	67	64	67	0	
12_13	2	67	69	67	69	0	
13_14	3	69	72	69	72	0	

As above table shows the total time required by each activities a total time for construction of a single storey building it requires 72 days with 11 days as a float.

b) By Precast Method

Table -5: Durations

PRECAST CONSTRUCTION DURATION			
SR.NO.	ACTIVITY	DESCRIPTION	DURATION
1	1_2	SURVEY , DESIGN AND LAYOUT	3
2	2_3	PRECASTING COMPONENTS	15
3	3_4	TRANSPORTING	3
4	4_5	ASSEMBLING AND FIXING	3
5	4_6	JOINT FILLING BY PCC	3
6	6_7	FIXING DOOR AND WINDOWS	3
7	6_8	PLUMBING	3
8	6_9	ELECTRIC FITTING	3
9	9_10	PLASTERING	4
10	10_11	FLOORING	2
11	11_12	CARPENTARY WORK	5
12	11_13	OTHER MINOR WORK	3
13	12_14	CLEARING	2
14	12_15	FINISHING OF DOOR AND WINDOWS	3

Table -6: Floated Time Calculation

ACTIVITY	DURATION	EARLIEST TIME		LATEST TIME		FLOAT	REMARK
		E.S.T.	E.F.T.	L.S.T.	L.F.T		
1_2	3	0	3	0	3	0	
2_3	15	3	18	3	18	0	
3_4	3	18	21	18	21	0	
4_5	3	21	24	24	27	3	
4_6	3	21	24	21	24	0	EXTRA
6_7	3	24	27	27	30	3	FLOAT
6_8	3	24	27	27	30	3	=
6_9	3	24	27	24	27	0	14
9_10	4	27	31	27	31	0	
10_11	2	31	33	31	33	0	
11_12	5	33	38	33	38	0	
11_13	3	38	41	41	44	3	
12_14	2	38	40	40	42	2	
12_15	3	38	41	38	41	0	

As above table shows the total time required by each activities a total time for construction of a single storey building it requires 41 days with 14 days as a float.

c) Time Comparison

Table -7: Time Comparison

S.N.	CONVENTIONAL			PRECAST			TIME SAVED
	ACTIVITY	DAYS	TIME	ACTIVITY	DAYS	TIME	DAYS
1	1_2	3	3	1_2	3	3	0
2	2_3	8	48	2_3	15	24	24
	3_4	15		3_4	3		
	4_5	25		4_5	3		
				4_6	3		
3	5_6	3	3	6_7	3	3	0
4	5_7	3	3	6_8	3	3	0
5	5_8	3	3	6_9	3	3	0
6	8_9	6	6	9_10	4	4	2
7	9_10	4	4	10_11	2	2	2
8	10_11	5	5	11_12	5	5	0
9	10_12	3	3	11_13	3	3	0
10	12_13	2	2	12_14	2	2	0
11	13_14	3	3	12_15	3	3	0
						TOTAL	28

The above table shows the time comparison between conventional and precast method as you see the total time save by activity is the **28 days.**

V. ADVANTAGES

1. Concrete is cast off site
2. Identical forms can used several times
3. Batter quality control
4. Control on curing
5. Un affected by weather , when casting
6. Construction in less time
7. Waste materials can be used (fly ash)
8. Fire resistant
9. Can avoid air born pollution on site (dusting)

VI. DISADVANTAGES

1. Costlier for small projects
2. Required skilled workers
3. Transportation is costly of large members for small projects.
4. It's required to be design and detailed for transportation, erection.
5. Required different site for its production

VII. RESULT

1. Conventional method brings construction Cost 30 to 40 % down than precast method for single story buildings.
2. Precast method brings construction Cost 10 to 15% down (for larger identical structure) as compared to conventional method.
3. Precast Technology can save time up to 64% compare to conventional method.

VIII. CONCLUSION

1. It has good quality control.
2. Construction speed can be increased by precast construction
3. The need for staff in precast construction is very small.
4. Installation and connection of precast construction is also very easy.

IX. FUTURE SCOPE

1. Precast Construction not only speeds up work but also enhances the workability and quality of construction.

2. Precast Concrete allows workers to cast precast components, fixtures and install utility access.

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