International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

A Comparative Study on Precast / Prefabricated Structures and Cast Insitu Structures

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Abstract: ***My project report is on precast and merits of precast structure where my part is to identify various factors which gives signification importance to precast fabrication with respect to cast in situ. I.e. the importance of precast in today is world in especially with reference to speedy, safes cost effective construction for developing nation like over India.***

Keywords: Estimation and costing, excel, auto cad, case study

1. Introduction

There are 5 basic topics covered in this project with each having its own constraints

1) Cost comparison b/w conventional and prefab units
2) Present housing approach in India and it's extension to prefab housing
3) Sustainability of prefab housing units
4) Implementation of prefab housing unit in major disaster prone areas
5) Futuristic housing

2. Literature Review

Elias IssaSaqan (1995) studied the evaluation of ductile beam-column connections for use in seismic-resistant precast frames. Four types of ductile connections were considered in this study. Four half-scale models of prototype precast beam-column connections subjected to reversed cyclic loads have been constructed and tested. The experimental study demonstrated that it is possible to design and construct precast beam column connections, where beams and columns are joined with ductile connecting elements, to withstand severe inelastic deformations resulting from earthquake forces.

Bindurani, P, A. Meher Prasad, Amlan K. Sengupta (2013) Analysis of Precast Multistoreyed Building - A Case Study, International Journal of Innovative Research in Science, Engineering and Technology (ICEE 2013), 2013: This study presents the modelling of connections in a wall type precast building system. A case study on a 23-storeyed building, made up of precast wall panels and slabs, to study the modelling of vertical joints in terms of shear transfer, is presented in the paper.

R. Vidjeapriya and K.P. Jaya(2011), Behaviour of Precast Beam-Column Mechanical Connections under cyclic loading, ASIAN JOURNAL OF CIVIL ENGINEERING (BUILDING AND HOUSING) VOL. 13, NO. 2 (2012), 2011: Experiments were conducted on 1/3 scale models of two types of precast beam-column connections and a monolithic connection. The precast connections considered are the beam-column a connection in which beam is connected to column with corbel using (i) J-bolt and (ii) cleat angle. The specimens were subjected to reverse cyclic loading. The experimental results of the precast specimens were compared with those of the monolithic connection.

P. K. Aninthaneniand R. P. Dhakal (2014), Conceptual development: low Loss Precast Concrete Frame Building System with Steel Connections, 2014 NZSEE Conference, New Zealand, 2014, Schematic development of a sustainable demountable precast RC frame system, in which the precast members are connected with steel angles/plates, steel tubes/plates and high strength friction grip (HSFG) bolts, is discussed. The concept of this system allows a mechanical pin to be used in the gravity frame connections such that only the seismic frames share the lateral force imposed by earthquakes and the gravity frames do not damage at all in earthquakes. In the proposed precast structural system, damaged structural elements in seismic frames can be easily replaced with new ones; thereby rendering it a definitely repairable and low loss system, despite not being a damage avoidance solution.

3. Methodology

Prefabrication in India

Prefabrication in India began with the emergence of the Hindustan Housing Factory. The company was developed by the first Prime Minister of India, Pandit Jawaharlal Nehru, as a solution to the housing crisis that resulted from the influx of refugees from West Pakistan in the 1950s. The Hindustan Housing Factory pioneered the production of pre-stressed concrete railway sleepers to replace dilapidated wooden sleepers on Indian Railways. The company changed its name shortly thereafter to reflect the diversity of its operations. It is now known as the Hindustan Prefab Limited or HPL. Located in Delhi, today the government run company prefabricates primarily precast concrete for architectural and civil projects throughout greater India.

4. Cost Analysis of Building

For any construction project cost is an important factor. Total cost of a project can be determined by determining the individual cost of materials used in the construction process. Various cost reduction techniques have been employed for developing effective strategies in order to reduce overall cost of the project. This article specifically deals with the cost of the material employed during the construction of a 1400 sq.

ft. residential apartment, by conventional methods as well as construction through prefabrication.

Prefabrication and precast techniques have been developed to offer speed and economy to the construction process. In civil engineering, time is money and consequently time saving is the key to save as much funds as possible without compromising the market demand

1) In prefabricated construction, as the components are readymade, self supporting, shuttering and scaffolding is eliminated with a saving in shuttering cost.
2) In traditional construction, the repetitive use of shuttering is limited, as it gets damaged due to frequent cutting, nailing etc. On the other hand, the mould for the precast components can be used for large number of repetitions thereby reducing, the cost of the mould per unit.
3) In prefabricated housing system, there is saving of time as the elements can be casted before hand during the course of foundations being laid and even after laying slab, the finishes and services can be done below the slab immediately. While in the conventional in-situ RCC slabs, due to props and shuttering, the work cannot be done, till they are removed. Saving of time means saving of money.

COST ESTIMATION FOR IN-SITU STRUCTURES

S.No.	ITEM	QUANTITY	RATE	AMOUNT
1.	P.L Cement concrete 1:5:10 in the foundation & floors including labour& materials.	30.00m³	3000.00	90,000.00
2.	Class-150 brick work in the foundation in 1:6 cement & fine sand mortar including labour& materials.	54.00m³	4800.00	2,59,200.00
3.	Class-150 brick work in 1:5 cement & fine sand mortar in superstructure including labour& materials.	52.00 m³	5100.00	2,65,200.00
4.	R.C.C work in the Doors, Windows, Lintels, Beams, & Slabs in 1:1½:3 including labour& materials.	31.00 m³	6800.00	2,10,800.00
5.	Reinforcement @ 1.25 %	30.50 ql.	6500.00	1,98,250.00
6.	P/F Door frame. Fabricated with Malaysian, sal wood, including labour & material. Section Size 2½"x4"	47.00 Rm.	525.00	23,625.00
7.	Painting of doors & Window frame with black Japan on rear side and wooden primer on the front side including labour and material.	47.00 rm.	42.00	1,974.00
8.	P/F timber shuttering and scaffolding for casting of lintels, beams,slabs, brick work & plastering the building	448.00	250.00	1,12,000.00
9.	12-15 mm. thick plastering of single coat on fair & rough sides in walls in 1:4 cement & sand mortar including labour& materials.	555.00 m²	240.00	1,33,200.00
10.	P/F Of waterproof flush doors as per design including fixing of hinges screw, latch, handle and labour excluding door closed and door locks.	15.00 m²	2400.00	36,000.00
11.	P/F kajaria tiles flooring over 25mm base of cement mortar 1:4 laid and jointed with white cement including labour& material.	8.50 m²	900.00	7,650.00
12.	P/F Of 600mm x 600mm Vitrified tiles flooring over 25 mm base of cement mortar 1:4 laid and jointed with white cement including labour &material	154.00 m²	1200.00	1,48,800.00
13.	12 mm thk. Gypboard false ceiling.	206.00 m²	900.00	1,85,400.00
14.	P/ F of Door Closers.	5 Nos.	2100.00	10,500.00
15.	P/ F of Door locks.	8 Nos.	2100.00	16,800.00
16.	Internal Wall & Ceiling painting with base of Birla putty, one coat primer, & two coats of 1st quality plastic paint	550.00 m²	195.00	1,07,205.00
17.	External wall painting with base of Birla putty, one coat primer & two coats of 1st quality Exterior paints.	175.00 m²	180.00	31,500.00
			TOTAL Rs.	18,38,104.00
18.	Electrical Fixtures			
	lighter	10Nos.	1800.00	18000.00
	Ceiling fan	2 Nos.	2400.00	4800.00
			TOTAL Rs.	18,60,904.00

5. Cost Estimation For Pre-Cast Structure

SCH	Sample Flat 1440sqft with both side slope, Wall height 10ft & Center height 12ft.				
SCHEDULE OF QUANTITIES					
Item No	Item Description	Qty	Unit	Rate	Amount
1	Foundation upto Plinth				
a	Excavation of soil [illegible]	0	sq.ft.	0	0.00
b	PCC in [illegible]: Providing 75mm thick PCC 1:[illegible]				
c	DPC Floor: Providing 40mm thick DPC flooring over the existing plinth after [illegible] work being completed				
d	Providing 25mm thick plaster on outer area of plinth as a complete item work				
2	Wall Solutions- External Walls- 75mm				
	Providing & fixing 75mm thick [illegible] aerated cement sandwich	3200	sq.ft.	188	601600.00
	modules made of light weight [illegible] cement concrete core composed				
	of [illegible] cement, [illegible], [illegible] and 4mm thick non asbestos fiber IS 14862:2000				
	and [illegible], having tongue and groove on				
	longitudinal edges of the modules. These Wall Panel modules are erected / installed				
	using Galvanised [illegible] 76 x 25 mm as a top and				
	bottom track for fixing to the floor & top of the wall respectively including all necessary				
	material required for erecting and fixing the wall panel with finishing the joints with Jointing				
	Compound complete as per direction of Engineer-in-charge.				
	Wall Paneling with Plaster Board of 12.5 mm thick	4100	sq.ft.	60	246000.00
3	Structural Steel				
	Fabrication & erection of Structural Steel for Columns, Trusses & purlins, joint plates,				
	bolts, [illegible], including two coats of red oxide primer as a complete item				
	of work as per the detailed drawing				
a	MS Column - [illegible] -		Kg		
	Girder - 200mm 200mm -		Kg		
b	Rafter - 200mm 200mm -		Kg		
c	Plate - 200mm 200mm 8mm -		Kg		
	Total Structural steel	[illegible]	kg	[illegible]	193750.00
4	FALSE CEILING				
	Plain Seam less ceiling by Gypsum Board complete with Putty & Plastic paint	1400	sq.ft.	70	98000.00
5	Roofing : Color Coated Galvalume : both side slope				
	ER-32/251 Color Coated Galvalume sheeting for roofing application with thickness 0.45 mm TCT. The profile is having 32 mm depth, 251 mm pitch with two stiffening ribs & anti capillary flute. The sheet width is 1090 mm & Covered width of 1006 MM. The basic material is High tensile 550 MPA steel with hot dip coating of 55% Al -43.5% Zn alloy having alloy mass of 150gsm (AZ 150) as per ASTM A 792, with 17-20 u DFT RMP	1700 (including overlap)	sq.ft.	65	110500.00
6	2 coats of Acrylic emulsion paint of ICI or Berger with 2coats of Primer & Putty	6800	sq.ft.	18	122400.00
7	Flush Door & Window	320	sq.ft.	325	104000.00
8			sq.ft.		0.00
9	Floor tile of size 600x600 of Ivory shade , Skirting & wall tile of size 225x225 (up to height of 4ft)	2200	sq.ft.	80	176000.00
10	Plumbing work with material	0	Set	0	0.00
11	Electrical wiring with ISI mark cable , switch & Socket. All other fixtures & electrical gadgets/ luminaires will charged extra as per actual or provided by client.	1400	sq.ft.	30	42000.00
	Total Complete Job Work				1694250.00
	Local Freight @ 1%				16942.50
	Vendors Margin @ 10%				169425.00
	Grand Total				1880617.50

Objective

Present Housing Approach in India and It's Extension to Prefab Housing

The Indian realty and infrastructure sectors are booming. The demands for these products have risen exponentially within these few years. Yet the construction industry is not able to meet the current demand of infrastructure required, India faces a crucial shortage of houses and current technology is reliable but it takes lots of time and money, so the need of the hour is the construction at a greater speed and lesser cost.

In spite of Best & Sincerest efforts by Government, there still exists a huge gap between the number of houses required and the number of houses still in categories of Economic Weaker Section (EWS), Lower Income Group (LIG) and Lower Middle Income Group, (LMIG). The overall shortage in EWS and LIG housing in India has been estimated at close to 2.65 Crores (26.5 Million) dwelling units as per report published by government and is expected to touch 3.8 Crores (38 Million) by the year 2030. Out of

current shortage of 2.65 Crores (26.5 Million) Units EWS alone has a requirement of 2.3 Crores (23 Million) Units.

6. Conclusions

In this project an extensive study is to be done on the precast structures in India. The concept of prefabrication/ partial prefabrication which are adopted for speedy construction, better quality components and saving in material quantities and costs are to be studied. The major emphasis is to be given on the cost comparison between precast/ prefabricated structures and cast in-situ structures. Thereafter, it will represent the present housing approach in India and its extension to prefabricated housing. This project will also highlight the sustainability of prefabricated housing units and the implementation of prefabricated housing units in major disaster prone areas. Futuristic housing techniques using precast units and their advantages related to time and economy will also be discussed using certain case studies of major precast structures. The reduction of waste due to use of precast structural units and utilisation of energy using prefab structures will be studied and represented

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