JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Experiment on PRECAST and its future

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Abstract :

In recent treads a wide range of building materials are available for the construction of civil engineering structures. The total cost of materials may be up to 60% or more of the total cost incurred in construction project dependent upon the type of project. Effective construction materials management is a key to success for a construction project. Construction waste is another serious problem in construction industry.

Various types of construction waste with different characteristics are created at all the stages of construction. Delays have been frequently reported as the cause of several conflicts that affect the different parties involved in construction projects. Project Time Management (PTM) includes a number of planning and controlling processes that are recommended for complying with requirements related to project time.

The performance of the construction industry and its contribution to the welfare of society in comparison to other industries such as the manufacturing industry has lately been the focus of many commissioned reports and academic research publications. The so-called —iron triangle of time, cost and quality have been the most important metrics of construction project performance, especially for the selection of appropriate procurement methods.

The perceived inefficiencies emanate from increasing construction costs, conflicts and client dissatisfaction, the fragmented nature of the industry, cost overrun, delays *and* lack of quality improvement. There is observed disparity in increase in housing construction costs and an apparent lack of quality improvement of infrastructure transport projects. Other empirical data from a secondary source were also used.

INTRODUCTION

- The type of building in which concrete is cast in reusable mould and then treated in a controlled environment (recasting plant) is called precast concrete. The cast concrete structure is then transported to the building site and then installed. Structural elements, such as concrete frames, concrete walls and concrete floors, etc., may be built using precast concrete.
- In order to reduce labor shortages, time delays and to produce better goods, developers and builders are now implementing precast technology in India. Concrete has been known for its toughness and aesthetic flexibility for centuries. Adding to the many well-known advantages of concrete, precast concrete has its own unique set of strengths. It is not only durable and versatile, but also safer for the environment and can greatly reduce construction time.

- Traditional concrete development can't stand up to precast concrete advantages and strengths, particularly when working with large projects. Precast concrete is specifically built and designed to have a substantially high span-to-profile ratio that allows it to handle loads better, eliminating the need for additional columns and supports inside the building's internal structure.
- Prefabricated concrete is widely used in the process of construction of building of civil and industrial use. This material allows to reduce the time of construction of the building what saves labor and financial resources.
- Further, there is another type of concrete products – monolithic. The question arises: "What is the main difference between monolithic and prefabricated?" The difference lies in a method of manufacturing and the sphere of application. For example, monolithic concrete is produced solely on the construction site. This method is very popular because an architect can plan custom and extravagant designs. However, this same technology is characterized with high cost and labor input.

  Prefabricated concrete products are manufactured entirely in a different way. They are made at the plant in a special technology process. In accordance with it, the production of prefabricated concrete is more technological and economical. What is more, the term of concrete products manufacturing shortens. Next, concrete units are delivered to the construction site ready-made and assembled according to the architect`s draft. The only disadvantage of this technology is the ability to manufacture prefabricated concrete modules only of well-defined shapes and sizes. Thus, the scope of application of this material for non-standard designs is rather limited

I.AIM AND OBJECTIVES

AIM:

To develop a program which can make construction, faster, cleaner and easier.

OBJECTIVE:

- To develop a template helping builders and contractors.
- Installation made easier for working labours
- Effective use of machinery

II.LITERATURE REVIEW

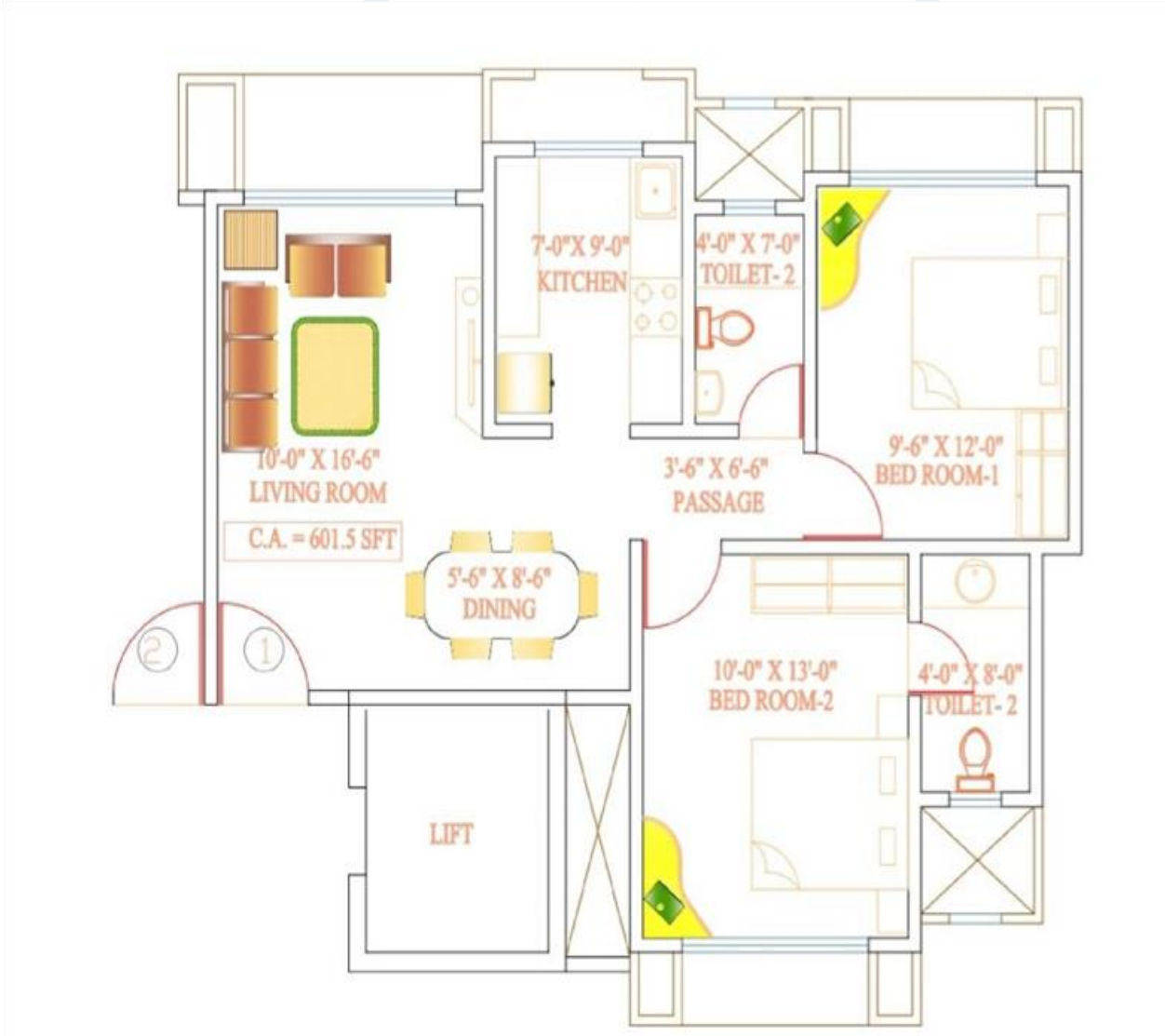
- Clay J. Naito ,Robert J. Dinan ,Jeff W. Fisher and John M. Hoemann - **Four precast wall panels were examined under five progressively higher explosive demands. The maximum inward deflections for all five experiments are shown in Figure 30 and Figure 31 for the control and sandwich panels respectively. The measured pressure and displacement time histories indicate that the wall panels examined provide a high level of protection.**
- Zhangfeng Zhu - **Experiments on Hybrid Precast Concrete Shear Walls**

Emulating Monolithic Construction with Different Amounts of Posttensioned Strands and Different Debond Lengths of Grouted Reinforcements

- Mr. Ram Kumar, Mr. Manoj Patterson, Mr. Sandeep Jain - **CASE STUDY ON USE OF PRECAST TECHNOLOGY FOR CONSTRUCTION OF HIGHRISE BUILDINGS**
- Shrikant R.Bhuskade , SwatiAmbadkar - **Experimental investigation of self compacting concrete in the precast technology to be used for the staircase**
- Sri Murni Dewi - **The experimental study of lightweight precast concrete slab with bamboo reinforcement**

III. METHEDOLOGY

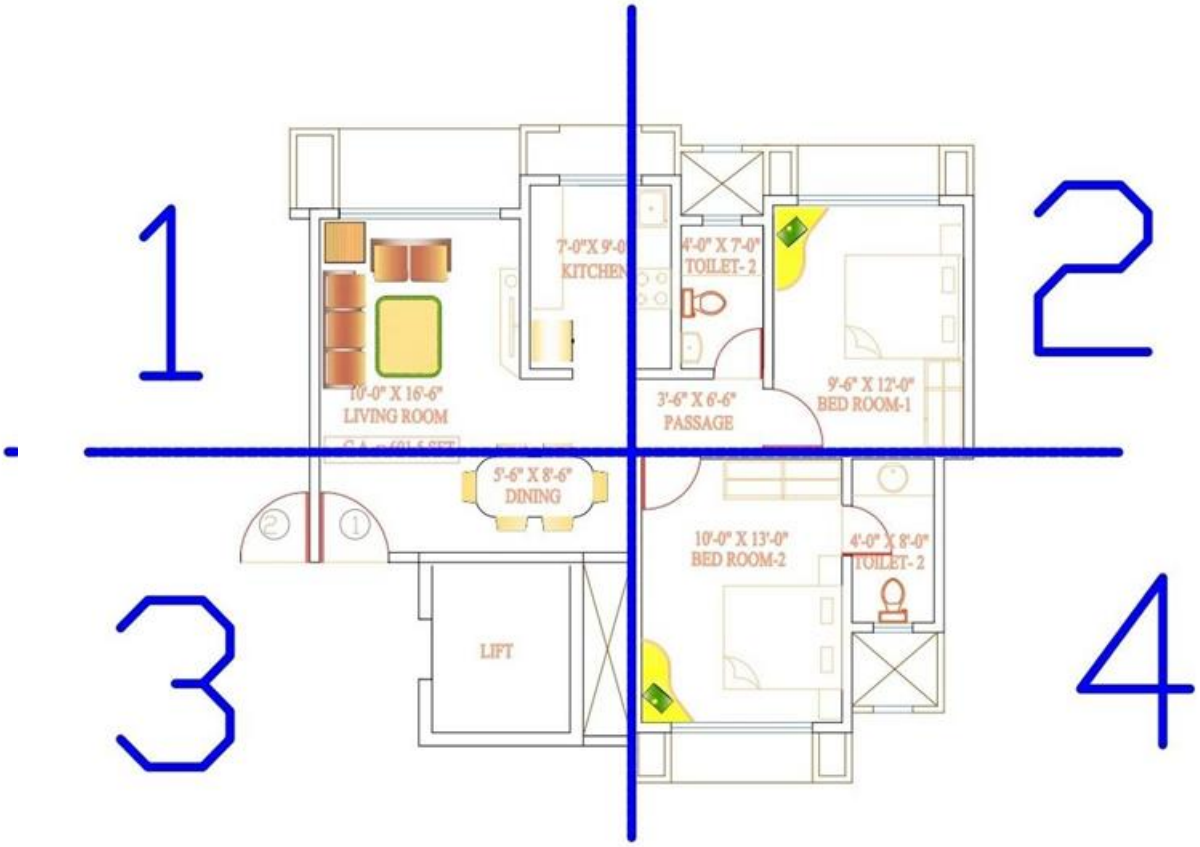
1) Designig of the modules



(Figure 4.1- Layout of flat)

- The image above is a layout of the flat which is going to be constructed.
- The flat is divided into modules so the modules can be delivered on site without any obstructions.

- The flat is divided in such a way that it can be loaded on the trailer compiling with all the road laws and regulations

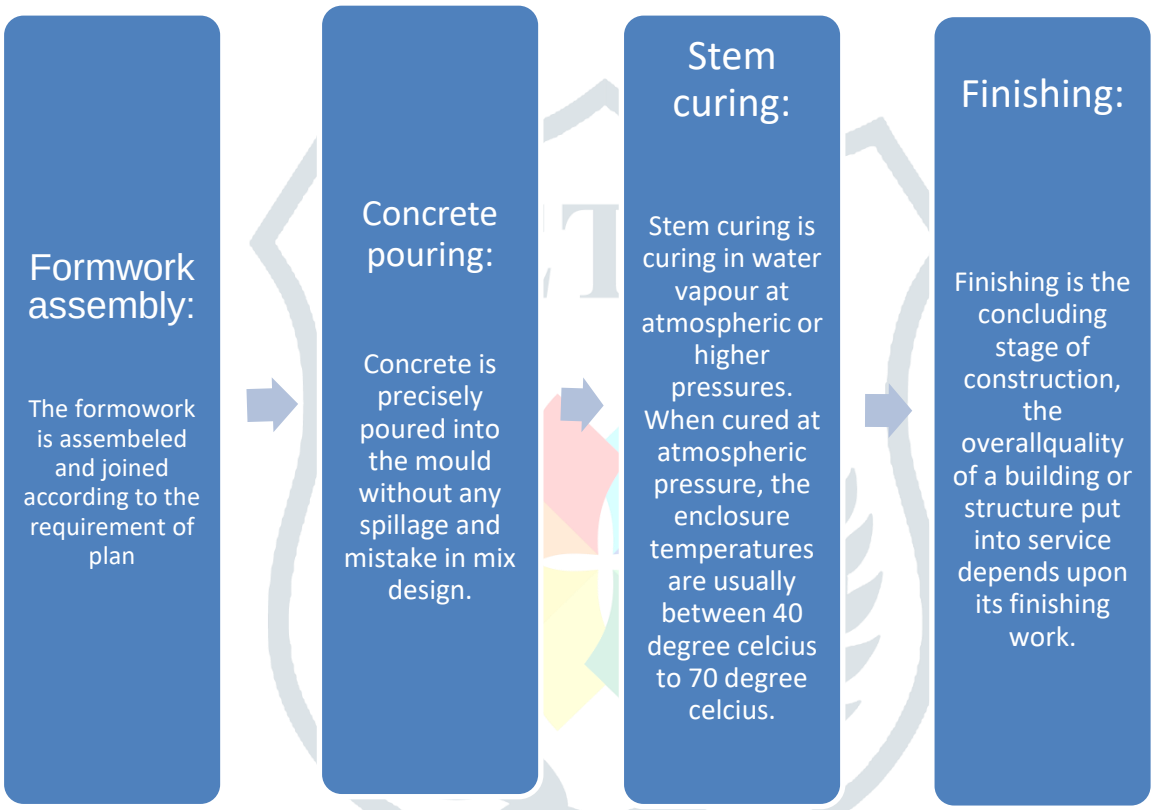


(FIGURE 4.2- DIVISON OF LAYOUT)

- In this way the flat is divided into 4 modules, these four modules are sent to the factory. In such the module is travel friendly and more amount of modules can be transported to the site for installation.
- Then the plan for the MEP and the plumbing is made before the casting of the structural members.

2) IN FACTORY PROCESS

The plan is sent to the plant of manufacturer and the process of manufacturing is shown below in a flowchart:

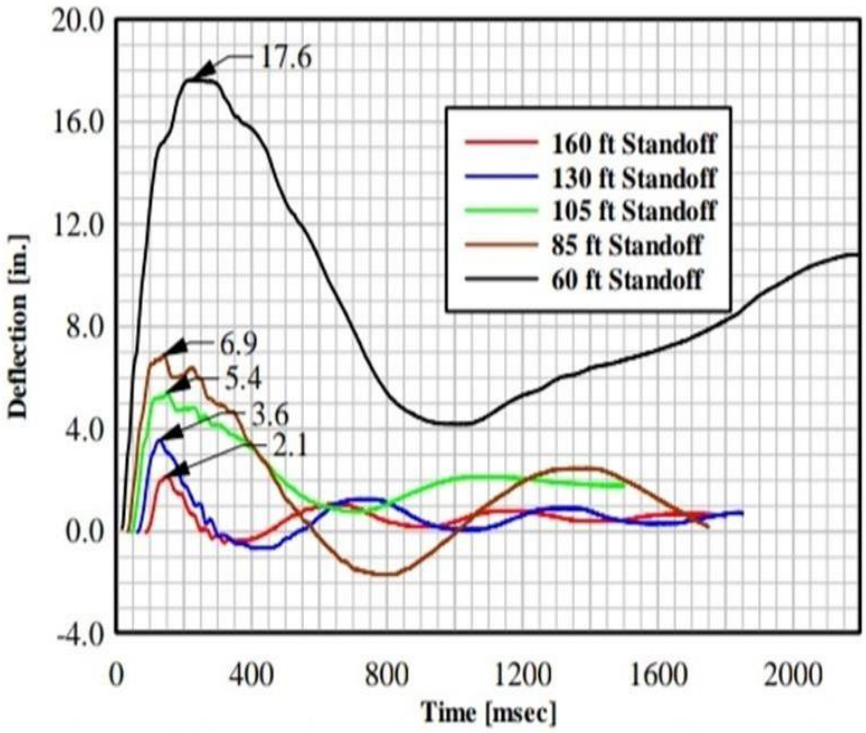


3) ON SITE INSTALLATIONS

- *Element of modules*

i. WALLS

- Normal brick and mortar masonry is not used in the precast space.
- Shear walls are used in these structures.
- The shear walls are attached to the plinth level.
- SUMMARY- Four precast walls are examined under five progressively higher explosive demands. The maximum inward defections are shown in figure below:

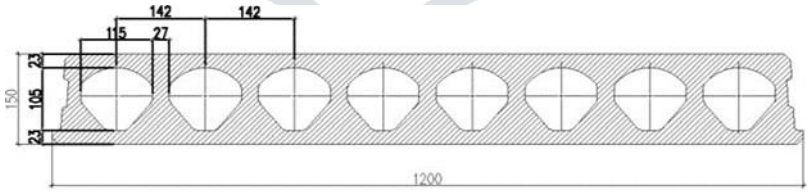


(FIGURE 4.3)

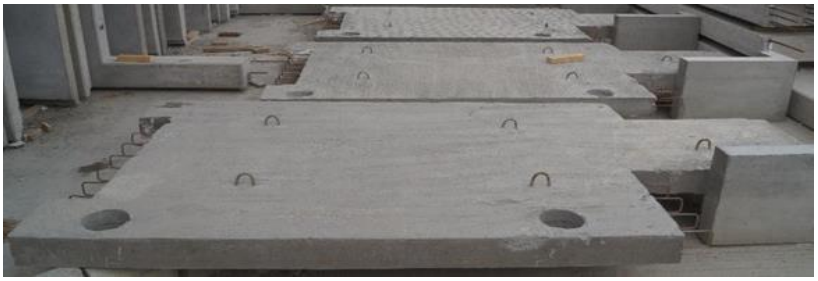
ii. SLAB

- The hollow core slabs are prestressed, precast concrete slabs, with hollow portions in the zones of zero stresses. They reduces the overall concrete dead load, concrete requirement and provides for better insulation.

- It is possible to achieve larger unsupported spans. Their general thickness used are 150, 200, and 265 mm. These slabs are casted 140m long at a time, with a fixed width of 1.2m. After steam curing the slabs are cut into smaller pieces as per site requirement. They are then delivered to site and installed in position using tower cranes. After installation as per drawings, a thin reinforcement screeding of 50-75mm is laid on the top, to seal the joints.



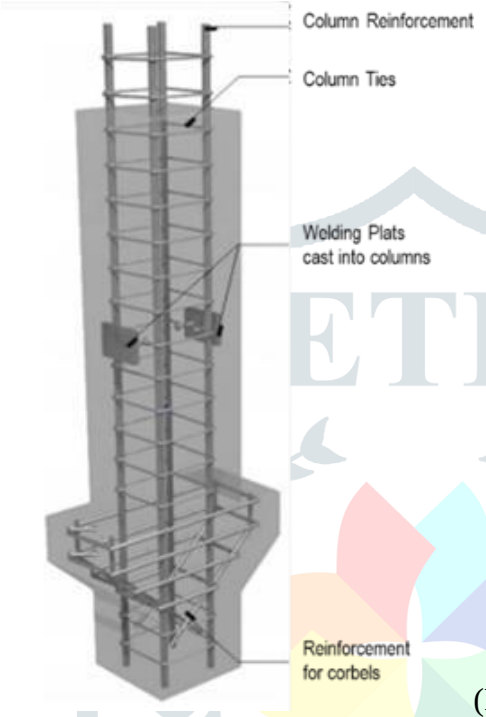
(Figure 4.4.a-Hollow core)



(Figure 4.4.b-Solid Slab)

iii. PRECAST COLUMNS

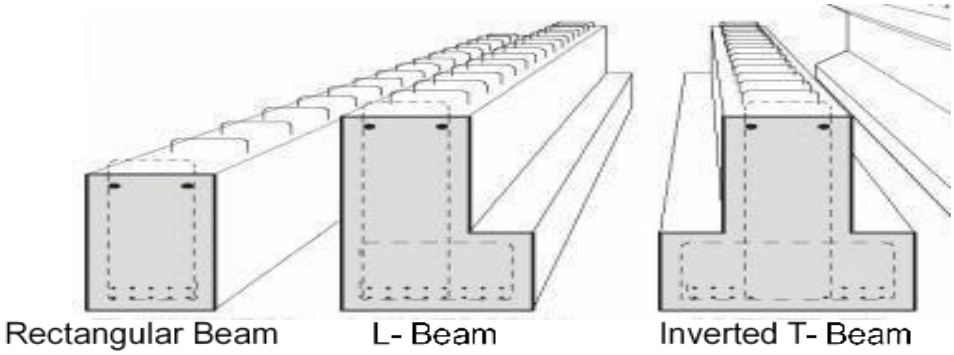
- Columns (Shear walls) in precast construction can either be done in CIS or precast. They are most suited in commercial, industrial bay buildings where thicker sections are needed. Precast columns are provided with corbel for simple beam column connections. Precast also allows for casting of triple height columns, thus faster erection.



(Figure 4.5- Typical precast column details)

iv. PRECAST BEAMS

- **There are two main categories of beams used in a precast structure. Internal beams are used where floor loading is approximately symmetrical, and external beams are used where floor loading is predominantly non-symmetrical. The use of precast beams with proper designed connections ensure higher structural stability.**



(Figure 4.6- Precast Beam Details)

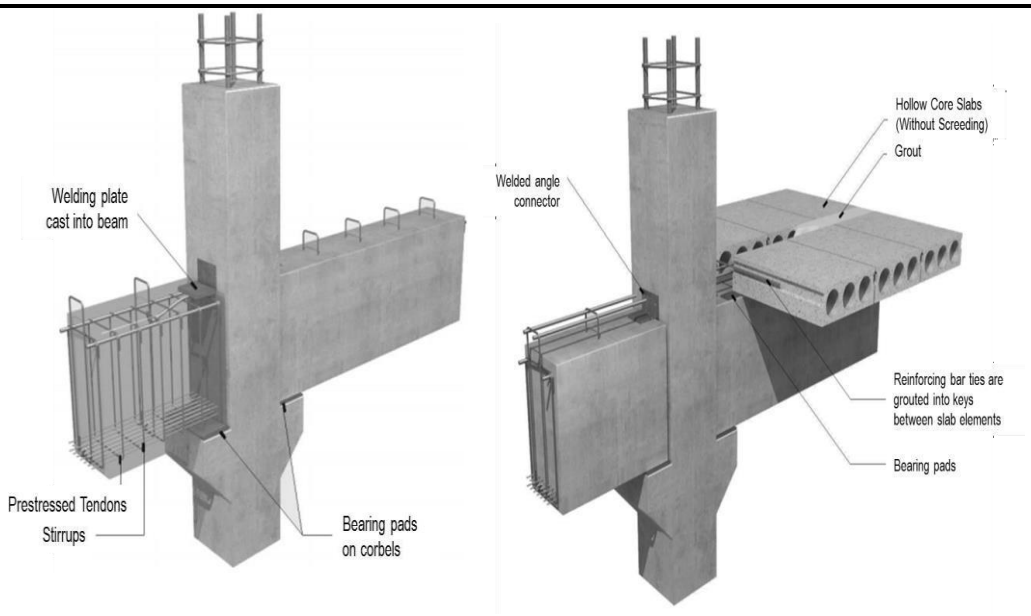
v. PRECAST STAIRCASE

- Precast staircase eliminates the complicated on site shuttering & reinforcement, and provides high quality finish. They can either be a single precast unit containing all flights and landings or separate precast flights & landings.

(Figure 4.7-Precast Staircase Details)

vi. DESING AND CONNECTION DETAILS

- The design philosophy of precast concrete construction is based on the build ability, economy, and standardization of precast elements. All loading & restraint conditions from casting to end use of structure are considered in design of precast members & connections. Connections are needed not only to transfer load but also to provide continuity and overall monolithic behavior of the entire structure. A complete system of precast elements is integrated to form a structure that behaves monolithically with sufficient strength, stiffness & durability to resist seismic & other dynamic loadings. The connection can be classified into horizontal & vertical joints. Some typical connections details are shown in figure:



(Figure 4.8- Typical connection details between In-Situ Shear Walls and Hollow Core Slab).

IV. RATE ANALYSIS:

1. Rate Analysis of RCC

- Assuming construction of wet volume10m^3 (all the rates are derived from dsr)
- Calculation of quantity with wastage = 5% of the total quantity
  = 5% of 10
  = 0.5+10
  = 10.5

- Dry volume = Increase wet volume by 60%
  = 60% of 10.5
  = 16.8m^3

- Volume of cement = dry volume/ total of ratio

  =16.8/1+2+4
  = 2.4M^3

- Number of cement bags = 2.4/0.034
  = 71 bags of cement
- Volume of sand = volume of cement x 2
  = 4.8 m^3
- Volume of aggregate = volume of cement x 4
  = 9.6

particulars	quantity	Rate	unit	amount
materials				
Cement	71	350	bags	24850
Sand	4.8	3500	m^3	16800
Aggregate	9.6	3300	m^3	31680
Labour				
Head mason	1	1200	day	1200
Mason	6	1000	day	6000
Male mazdoor	6	700	day	4200
Female mazdoor	6	700	day	4200
Bhisti	4	700	day	4200
Tools and plants	l/s	5000	day	5000
			TOTAL	98130

TABLE 1- RATE ANLYSIS BY RCC ON SITE

TOTAL COST OF CONSTRUCTION BY RCC METHOTD = 98130 RUPEES

2. Rate Analysis of Construction by Precast Technology

- *Assuming construction of wet volume10m^3*
- DRY VOLUME = 52% OF WET VOLUME
  = 10.52 M^3
- Volume of cement = dry volume/ total of ratio
  =10.52/7
  = 1.5
- No of cement bags = 1.5/0.034
  = 45 bags
- Volume of sand = volume of cement x 2
  =3
- Volume of aggregate = volume of cement x 4
  = 6

Particulars	Quantity	Rate	Unit	Amount
Materials				
Cement	45	350	Bags	15750
Sand	3	3500	m^3	10500
Aggregate	6	3300	m^3	19800
Labour				
Head mason	1	1200	day	1200
Mason	3	1000	day	3000
Bishti	2	700	day	1400
Tools and plants	l/s	5000	Day	5000
				56650

Total cost of construction by Precast method = 56650/-

V. ADVANTAGES:

- **SPEED-TO-MARKET**-Precast structural components are fabricated in a controlled plant environment and can be erected in weather conditions that would delay the full erection of steel components or CIS concrete. In general, the advantage of precast is that faster erection reduces the overall construction schedule and overhead costs. Compressed schedules, fewer on-site trades, and eliminating weather delays add up to reduced project costs.
- **QUALITY & DURABILITY** - Precast, prestressed products provide a long service life that far exceeds field-placed concrete partly because members are manufactured in plants under strictly controlled conditions. The controlled plant environment has offers easy verification of quality and a dedicated workforce. This means high-quality product can be manufactured every day, regardless of weather. The low water-cement ratio used in precast concrete creates a denser product that does not allow penetration of chlorides and other harmful elements as easily as field-placed concrete.recast with steel or cast-in-place concrete in hybrid construction can have cost and program benefits. Precast concrete brings accuracy, high-quality finishes and speed of erection to any hybrid concrete construction project.

- **ENHANCES SAFETY** - Precast products eliminate many of the dangers associated with on-site construction by providing a controlled, off-site fabrication environment. Precast reduces the amount of wet trade work on site, making them cleaner, tidier and safer.
- **SUSTAINABILITY** -Precast is perfect for today's focus on preserving resources and protecting the environment though sustainable building practices. It's a perfect Green Building product. Precast reduces overall life cycle impact on environment compared to other methods as it has lower wastage and high potential to recycle waste.
- **OPTIMIZATION & FLEXIBILITY** - Advanced automation and technologies used in precast plants optimizes the resource utilization, and produces an improved quality product with reduced tolerances, thinner sections, and engineered solutions. Also, it offers flexibility of space planning by allowing for longer spans which create larger open floor plans and increased flexibility in design. For architects, it can offer variety of different profiles. It is possible to cast the member of very complex design and shapes. Innumerable other advantages like high dimension accuracy, tight tolerances, minimal maintenance, acoustic insulation, thermal inertia, various surface finishes, colors, etc. can also be availed as desired.

VI. CONCLUSION:

- The precast concrete technology has already arrived in India, due to large size projects, need for quality construction with speed & reduced labour force. All these advantages can be exploited to the maximum by careful planning & designing**.**
- The rapid speed of the urban population in India from 1901 to 2011 led to a shortage of land, housing, congested transit, and basic amenities.

- The study of Ernst & Young and the FICCI show that there will be about a 65% labor shortage in the construction industry by 2021.
- The adequate planning and implementation of precast construction can fulfill the requirements of housing demands.
- The precast construction contains only 2% of shares in the Indian construction industry of USD 500 million.
- The use of the precast systems in India is mostly limited to infrastructure projects like bridges and flyovers.
- The GOI has accepted the use of precast concrete construction method in order to fulfill the housing demands.
- They already proposed to provide housing to everyone by 2022 majorly based on the precast concrete technology.
- As per the technical report submitted by the Ministry of Housing and Urban Poverty Alleviation, out of 18.78 million dwelling units there are approximately 96% which belongs to EWS and LIG households.

VII. REFERENCES

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