A review paper on analysis and design of precast building using etbas

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***Abstract* - Prefabricated building systems is widely adopted in public buildings as well as in private building projects. Prefabrication together with the standardization and mechanization has brought a substantial change in the development of the construction industry worldwide over last few decades. Recently in India use of prefabrication in building construction is increasing. With the adoption of more mechanization, computer aided manufacturing, and intelligent management systems. Analysis and Design of Precast building system requires knowledge of construction practice as well as structural integrity. Precast Concrete Institute (PCI) provides guideline related to precast building systems element design and various connection design. PCI handbook is based on the ACI 318 codal provisions. The precast building system includes precast hollow core slab, precast beam and columns. Different configuration of precast slab, beam and columns are studied. Precast building is analyzed considering dead load, live load, seismic forces, wind forces and their combinations. For modelling and analysis of building ETABS software is used. Precast structural elements of the building are designed as per PCI and ACI specifications. The connection between slab and beam, beam and column, column and column are designed and detailed. All precast elements are designed considering forces during handling in addition to forces due to gravity load and lateral loading.**

***keywords* - precast concrete structures, shear wall, design and analysis, ETABS 2016**

I. INTRODUCTION

Precast concrete is defined as concrete which is cast at location other than its final position in the finished structure. Precast concrete is produced under rigid quality control conditions in a pre casting plant. The concrete strengths used range from M30 to M45 grade, with the higher strengths being preferred to ensure durability and high cycle production rates in the plant. Cast-in-place concrete requires more formwork, and form can be reused only up to 10 times. For precast concrete, finished wood and fiberglass forms may be used up to 50 times with minor rework.

Precast concrete is a unit system of construction wherein a number of identical or similar components are assembled to produce the total building or structure. The pre-cast components may be pre-stressed pile, single-story or multi-story precast columns, pre-stressed concrete girders, single-T, double-T, hollow- core slab, or solid slab floor or roof members. Precast wall panels may be load-bearing or non-load- bearing. The concept of precast construction include those buildings, where the majority of structural components are standardized and produced in plants in a location away from the building, and then transported to the site for gathering.

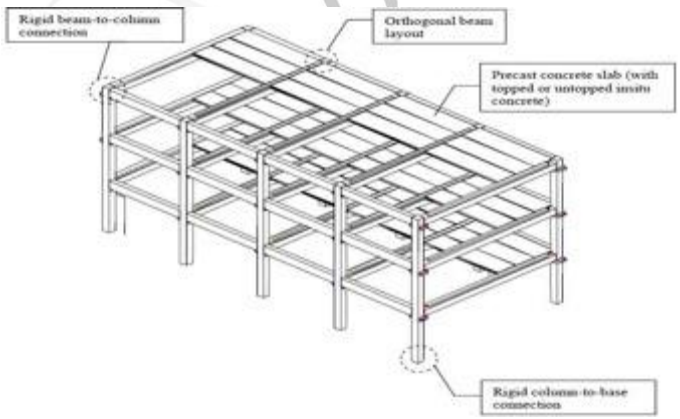

Fig.1: Precast building systems

The Different types of Precast Units are in common use. Though most are not formally standardized they are widely available, with minor local variations. Number of repetitive units is sufficiently large.

- Precast Wall Penal

- Precast Roof and Floor Elements
- Precast Beams and Girders
- Precast Columns
- Precast Shear Walls
- Precast Stair case

II. REVIEW OF LITERATURE

T.Subramani, R.Sathiyaraj, C.M.Harish, A.Ashwin, A.N.Naizam [7] Precast Concrete Is Well Known Technology In Which Some Standardized Units Which Are Manufactured In Factories Are Used For Fast Construction. The modern trend is to use concrete steel, treated wood, aluminium cellular concrete, light weight concrete, ceramic products etc. While choosing the materials for prefabrication the following special characteristics are to be considered as Light weight for easy handling and transport and to economic an sections and sizes of foundations,thermal insulation property ,easy workability. The use of precast concrete construction can significantly reduce the amount of construction waste generated on construction sites, Reduce adverse environmental impact on sites, Reduce the amount of site labour, Increase worker safety.

Khaja Rasool Thagaragunta , M. Helen Santhi, [4] This paper presents the method for analysis and design of precast building. The precast building behaves uniquely than cast in-situ building. The main aim of this study is to analyze and capture the behavior of precast structure for the applied gravity and lateral loads. Designing for Precast connections is a challenge for the structure because the wall has 200 mm width restricted and core wall 250 mm width. Accommodating the connections at different joints like interior joints with four beams, exterior joints with different beams connecting. Connection between wall to wall and wall to beam to carry sufficient moment and at the joint to resist horizontal and vertical shear coming from gravity and lateral loads.

Chandiwala Anuj,[2] Prefabricated building systems is widely adopted in public buildings as well as in private building projects. Precast concrete is produced under rigid quality control conditions in a precasting plant. The concrete strengths used range from M30 to M45 grade, with the higher strengths being preferred to ensure durability and high cycle production rates in the plant. The concept of precast construction include those buildings, where the majority of structural components are standardized and produced in plants in a location away from the building, and then transported to the site for assembly. These components are manufactured by industrial methods based on mass production in order to build a large number of buildings in a short time at low cost. Prefabrication together with the standardization and mechanization has brought a substantial change in the development of the construction industry worldwide over last few decades. Analysis of Precast building. All precast elements are designed considering forces during handling in addition to forces due to gravity load and lateral loading.

F. Biondini, L. Ferrara And G. Toniolo,[3] The seismic design of precast structures can be based on the standard capacity design criteria provided that a good seismic behaviour of the connections, without early brittle failures, is guaranteed. The knowledge of the seismic behaviour of connections, e.g. in terms of ductility resources, is so far lacking, and capacity design criteria for their proportioning are required. Based on this need, this paper presents, in an overall organized way, the capacity design criteria to be applied to the different types of connections which may be present in a typical precast concrete structure for industrial buildings, when designed for earthquake resistance.

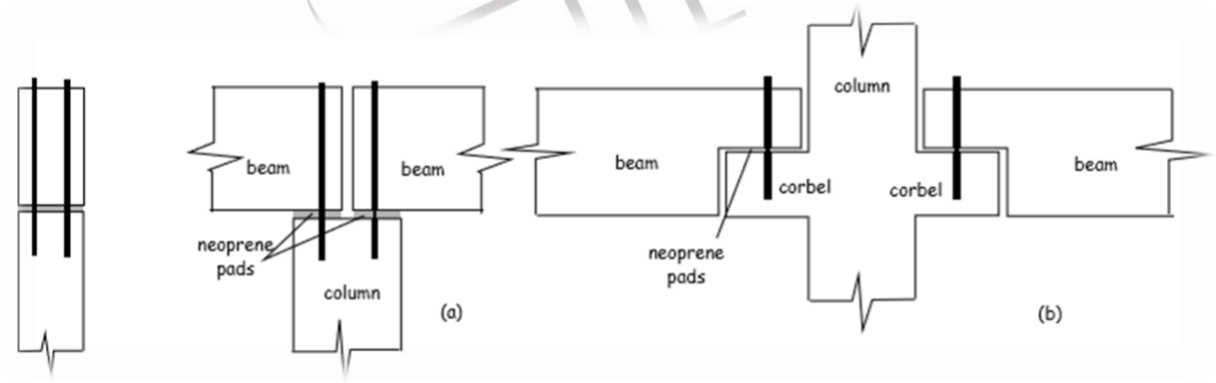

Fig 2. Beam-column connection for roofs (a) and for floors (b).

Nitesh M. Jogdand, P.B.Murnal [6] Precast Structures are widely used for construction in India. Due to construction and design faults, the behavior of these structures, when subjected to seismic events have been weak. The failure have mostly found at the connection of members of the structures. So the behavior of the connection have been critical in Precast Structure especially beam-column connection. Most designers assume the beam-column connection as an ideally hinged connection that leads to inaccurate values. A Precast Structure consists of large units jointed by connections whose function is to transmit compressive, shear or tensile forces or bending moment. Typically connections with dowels are preferred considering its ease to assembling. In this case one or two dowels protrude from the top of the column and enter into the sleeves inserted in the beam.

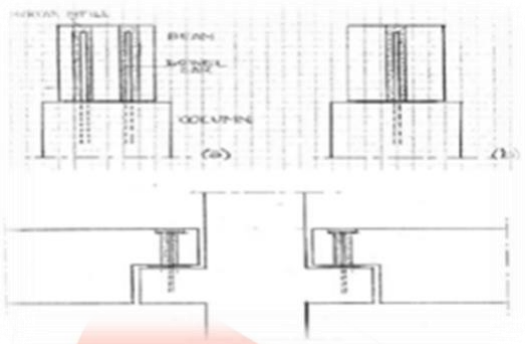

Fig 3. Dowel Connections for Beam to Column

The flexibility of the Precast Building is increased by considering the Beam-Column Joint as semi-rigid.In Time History Analysis it is found that due to increased flexibility of the Precast Building compared to RCC building the Top Displacement is increased whereas the Base Shear has decreased in X-direction. The Storey Drift at the Parking floor is almost doubled in Precast Building to the RCC building. This is due to no walls present at the ground floor reducing the stiffness of the story compared to the above storey.

Akash Lanke, Dr. D. Venkateswarlu [1] Precast concrete is well known technology in which some standardized units which are manufactured in factories are used for fast construction . Though the technology is developed many years ago but the implementation is not up the mark in our country. In this study we have carried out detailed study of various concepts of precast. Now a day's pre-cast technology include a variety of architectural and structural applications which can be used in various element of building. As the population continuously growing rapidly, so the need of rapid or fast construction is requirement of future generation. Precast concrete construction methods are become feasible and alternatives method or solution in such applications Ides buildings. Precast concrete is the ideal solution for residential because the structure of residential buildings

are somewhat standard so the construction of same type of elements are easy and result in to cost saving on if its production is in bulk. Precast concrete provides stability, Flexibility, sound durable and adaptability with cost efficiency. Precast concrete construction required less construction process which saws money on financing costs.

Table 1 Comparison of precast & Cast In-situ on basis of Duration

Operation	Precast	Cast in place
Excavation, Filling, etc.	SAME	SAME
Pouring & Curing Strip	1	2
Pour. Cure. Strip Wall	NA	2
Pour. Cure. Strip Top	NA	2
Damp proof course	NA	1
Install on site	1	INCLUDED
Total Duration in Days	2	7

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III. CONCLUDING REMARK

After the detailed review paper, following remark can be concluded,

- The use of precast concrete construction can significantly reduce the amount of construction waste generated on construction sites, Reduce adverse environmental impact on sites, Enhance quality control of concreting work, Reduce the amount of site labour, Increase worker safety.
- Connection details are accommodated for 900 mm deep beam with 200 mm shear wall with cottering bars and loop bars to resist the lateral and gravity moment by offering resistance to the design moment. Hence the entire structure is designed for lateral and gravity loads.
- L beams on periphery are subjected to horizontal moment in addition to shear and bending moment while rectangular and inverted T beams are subjected to shear force and bending moment only.
- This study we can be conclude that the precast concrete system is economical than conventional cast in place method 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.
- In observation the most important thing is to be observed project is in precast construction technique is the time effective it require less time to construct. It requires skilled worker and qualified contractor, Lower initial cost especially for large project.

IV. ACKNOWLEDGMENT

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