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DISCUSSION ON PRECAST PRESTRESSED PANEL AND ITS DESIGN USING FINITE ELEMENT SOFTWARE FOR ECONOMICAL HOUSE

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Abstract: In recent time there is a need for the construction industry to revolve the development trade compelling it to be lot more economical in both if structural design and the construction execution. The developing approach should cover that it ought to be economical, fast and maintain the standard. For the construction concrete is the world widely used material because of its strength, handiness and affordability. The replacement of the insitu practice of construction that is very conventional form of construction is the use of Precast concrete members in the industry because of its fast and rapid construction.

For the structural designing, to avoid long mathematical calculations and performing the tests in experiment which not only consumes lot of time but also is very cost consuming since the material used for testing adds the cost, the solution can be the use of Finite element method. In this discussion the use of Finite element tool is suggested to analyze the prestressed member. The software for this analysis and design is Ansys where the model and analysis of the element is less time consuming and is very cost effective.

Index Terms **– Precast concrete, finite element method, Ansys software**

I. INTRODUCTION

These days various factors are of great importance in the process of installation of structure like cost of construction, quality as well as the speed of construction. The precast concrete members the best solution for the economic advantage in construction speed in the Idustry.

The connection between two panel of precast member plays the vital role in deciding the reliability and speed of construction. It is seen per the different literature that the precast concrete panel have an overall advantage over the conventional practice of construction that is insitu construction practice. The advantages considered are its speed of construction, concrete of high strength and reliability.The reason of adopting precast technique in recent constructions is to overcome the issues concerned with the speed, cost and quality of the construction.

The features that make it different include its durability, sustainable building option, energy efficiency, property to reduce moisture and air infiltration, recyclability, low maintenance and light weight. The connection between two members are engineered so well that it acts as the monolithic behavior of the structure.

The finite element method is the effective method in determing the static nature and performance of the structure which saves time in designing and is cost effective and also increase the safety of the structure.

The long and tedious mathematical methods and experimental work were used earlier in analyzing large structures, such as high buildings, long bridges, and others. Since the accuracy involves and requires embellished techniques so most of the designer time gets involved devoted in performing mathematical analysis. The Finite element methods can be replaced and thus lets designer's free from concentrating on mathematical calculation and experimental work technique where both time is applied, cost is applied and allow them to use more time on accurate representation of the intended structure and review of the calculated performance. This is how construction time can be controlled using precast structure and to avoid long mathematical calculations and experimental testing by adopting best use of computer software can be utilized.

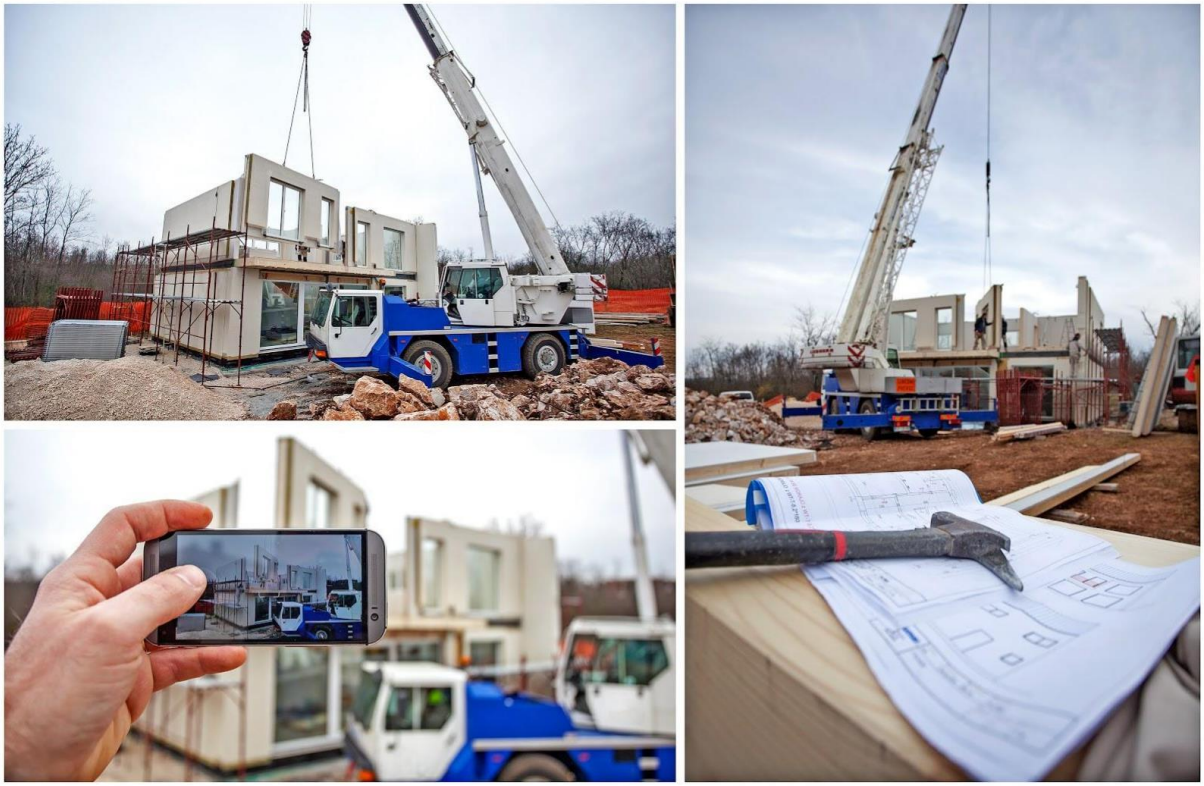

Fig.1 Typical Precast material construction [5]

II. FINITE ELEMENT METHOD

The effective technique of determining the static performance of structures is the Finite element analysis because of design time, price effective in construction and increase the security of the structure. The advance mathematical ways and experimental work were used antecedently in analyzing massive structures, such as bridges, tall buildings and others. Since the accuracy involves and requires complicated and embellished techniques so the major part of the designer work could be consumed and devoted in performing mathematical analysis.

The (GUI) interactive user interface used in the program helps to ease the generation of complex model as a finite element and the output gets is readily similar form and very convenient. This is time consuming and the analysis of the structure is more accurate which helps economically and saves material costs helps to enhance the overall safety.

It divides the problem domain into several small elements. The knowledge of physical laws is applied in analyzing the elements The sub-domain behavior, shaped by nodes and element, is then approached through the piecewise linear functions to represent function which is continuous of an unfamiliar and unidentified field variable. The discrete values of the field variable at the nodes is represented by the unknown. The set of linear algebraic equations which represents the full system are developed for the elements by the use of appropriate principles and by solving them it returns the necessary field variable.

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III. MATERIALS

1. CONCRETE

The material often used due to its high structural honour and low maintenance requirements for the outside walls on commercial buildings is the concrete. The concrete unlike other building materials, develops most of its strength in the first 30 days and continues to increase it over the life of a building. The concrete proved to be a variant where the structures tends to vitiate over the period of time rather than improving. The process of hydration being the motive behind its non-traditional of advanced years, continues and complexes inside the cement gets elongate as the compounds get lengthened and interlink and create a stronger unit.

2. STEEL REINFORCEMENT

The high tension and shear strength of the steel compensate for the concrete deficiencies. The behavorial similarity in changing environments that is steel shrinks and expands with concrete helps in avoiding cracking. Steel bars made from steel with ribbing is used to bond with concrete for concrete reinforcement. The Rebar 's verstality is enough in getting bent or assembled to support the shape of any concrete structure. The most common form of concrete reinforcement is Rebar made from steel with ribbing is used to bond with concrete. The steel bar with the carbon content is used as rebar material.

IV. CASE STUDY

This is the Medical College Block situated in Chittoor. The construction is of Precast pretension concrete materials. The panel are all build in the manufacturing unit and are transported to the site and assembled unit by unit.

Fig. 2) Precast prestressed concrete Medical College building at Chittoor [1]

Step 1
The Construction land is excavated and dwelled to have a flat surface.

Fig. 3) Site for construction [1]

Step 2
Land is eroded and made flat for the foundation work.

Fig. 4) excavated land [1]

Step 3
The precast members manufactured in industry can easily be transported to the site.

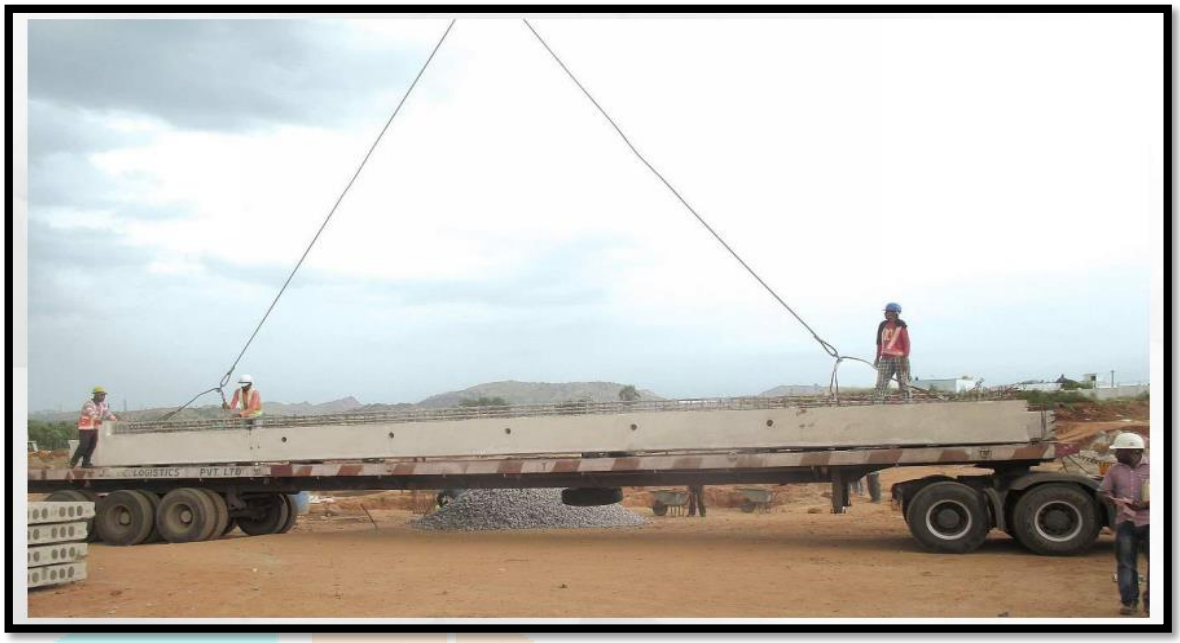

Fig. 5) Members taken to the site [1]

Step 4
Through lifting equipment, each individual members can be located and stacked to their designed place.

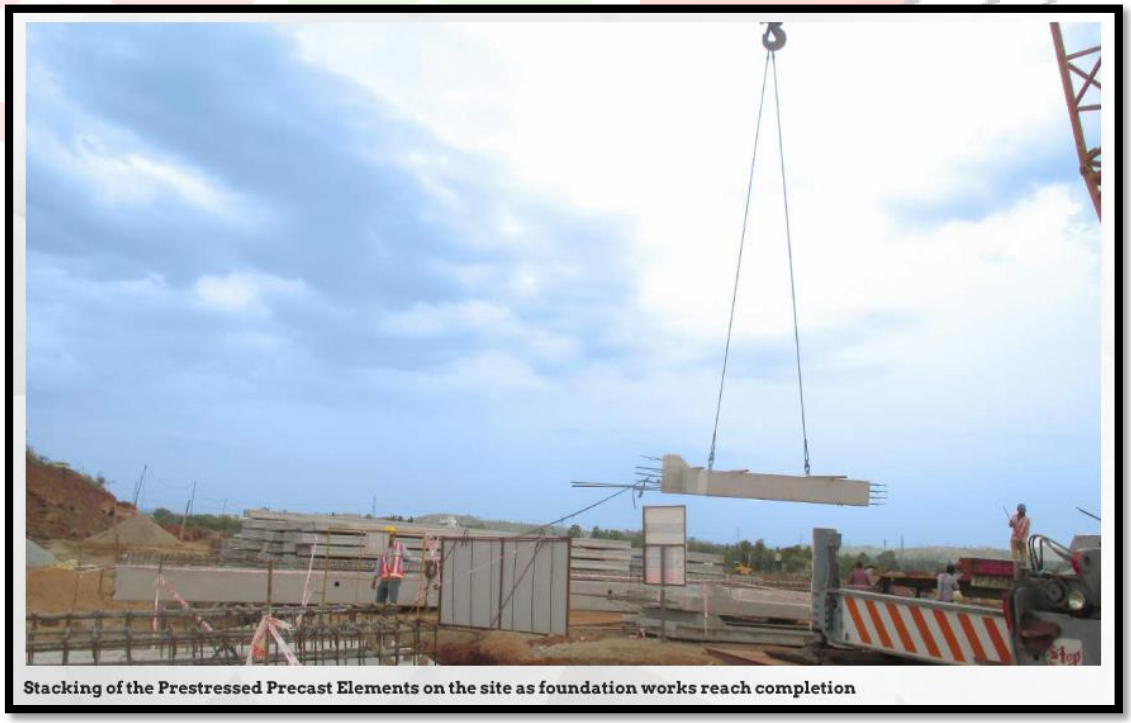

Fig. 6) Lifting of members [1]

Step 5

The erection process is speedy and can be done simultaneously for each individual members. In the picture beam, columns and retaining wall are erected at one time.

Fig7) Assembling of different members [1]

Step 6

Each individual slab, beam and column are jointed at one part.

Fig 8) Stilt floor [1]

Step7
Beams and columns are provided with the corbel to support slab and beams respectively.

Fig 9) Corbel for support [1]

Step 8
First floor and second floor view of the construction.

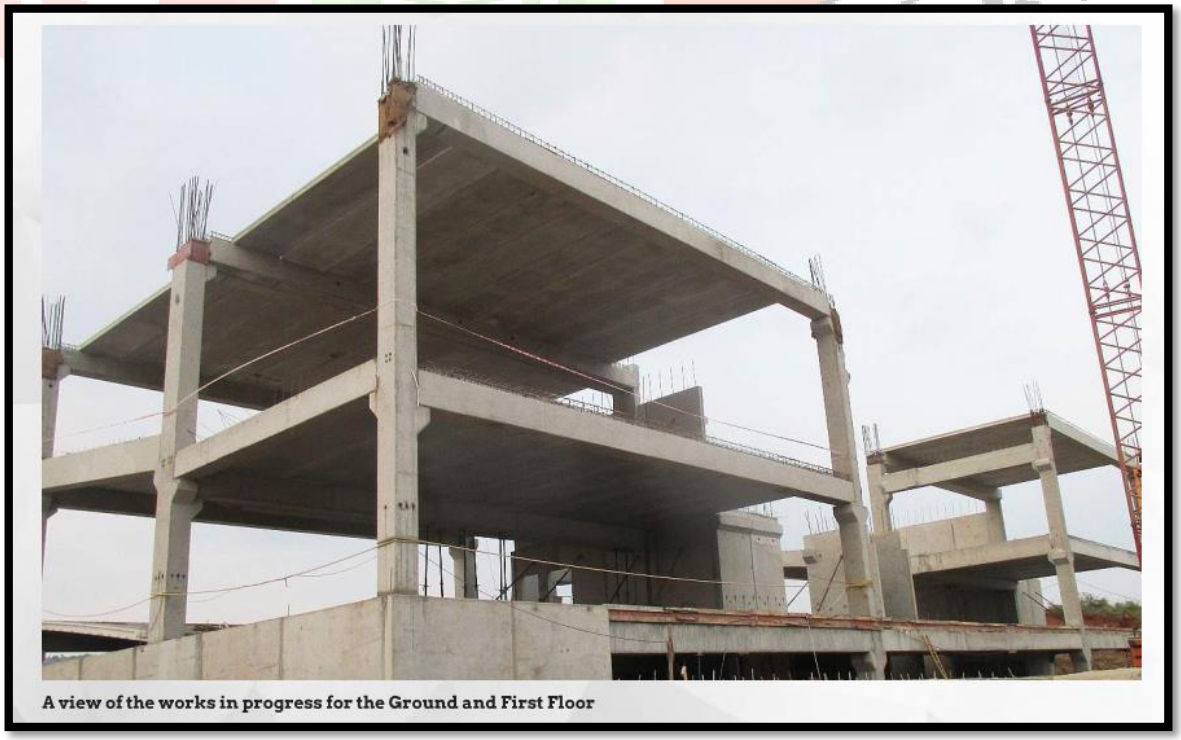

Fig 10) Primary assembling [1]

Step 9
First and second floor almost complete.

Fig 11) Building almost comleted [1]

Step 10
Then the non-load bearing walls are infilled through the panel made at the site.

Fig. 11) Front view [1]

Step 11
The process is complete with all flexural and non-flexural members.

Fig 11) Building is completed using precast member [1]

V. CRITICAL LITERATURE REVIEW

Siva Priya (2016) In this study focus was given on time and price of the precast materials used in Indian industry. The old method of construction and prefab construction was compared and find out that overall prefab is much faster and economical to be used in construction industry. [2]

Abhinav S. Kasat & Valsson Varghese (1988) In this paper the writer want to tell that Finite element method is the most effective method to determine the static performance of the structure where conventional method where long mathematical calculations were needed for the design of the structure such as bridges take lots of time. FEM analysis greatly reduces the designer's time in doing long calculations involved in the construction. This greatly helps the Engineer on record to concentrate more on the design part thus helps to increase the efficiency and productivity of the structure. [3]

Akash Lanke (2016) This work was done to get the results and compare precast prestress and rcc building in terms of its price, time taken in construction and quality achieved. It was found that the precast building was very fastly erected and the total price involved in an overall construction work was much less than the old conventional method applied. [4]

VI. METHODOLOGY

The method used to analyse the panel is Finite Element Method. The Precast and Precast pretension panel member are analyzed with finite element method with ANSYS software and the results are then compare.

VII. CONCLUSION

1. The precast members are safe, economical and very easy to install.
2. The time taken for the complete erection is very less as compared to the in-situ method of construction.
3. Finite element analysis software should be used which saves time and best stimulation can be done. This saves the design time and avoid long mathematical calculations and experimental work.

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