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"New Construction Techniques For Affordable Housing In Fast-Track Manner"

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ABSTRACT— *The real estate construction industry is known for practicing old techniques and conventional technologies. Their main focus is not on working innovatively rather they focus on working economically by compromising with cheap material which affects durability and performance of building ultimately decreasing the life of structure but the fact is that the path to achieving economy goes through proper technique and innovative technologies. Low-cost housing and affordable housing is the only way to provide the shelter to the middle class and poor families which can be achieved through the use of proper techniques. Due to the scarcity of natural materials and there negative effects on the environment, causing us to find their replacements. Replacing the natural material with a waste product "GLASS FIBRE REINFORCED GYPSUM (GFRG)" which primarily uses gypsum which is the waste from fertilizer industries can be used as a very good alternative. Prefabricated product "EXPANDED POLYSTYRENE (EPS)" can be used as an excellent replacement for conventional technologies. Conventional formwork can be replacement by more efficient technologies such as ALUFORM, TUNNEL formwork and PLYWOOD formwork which are beneficial for a long run. This paper will focus on the comprehensive comparison between different technique and technologies which give maximum results in a given conditions and encourage construction industry to choose appropriate technique according to amenities and conditions available at the site. This Paper can be used as a reference to find which is best among GFRG, EPS, ALUFORM, TUNNEL FORM, and PLYWOOD FORM over conventional in a particular reference.*

KEY WORDS— Low-cost housing, Aluform technique, Tunnel formwork technique, EPS (expanded polystyrene sheet), GFRG (Glass Fiber Reinforced Gypsum), Plywood Formwork, Conventional technique**.**

i) Introduction

The construction industry is the second most powerful industry after agriculture industry. Changing conventional methods and adopting new technologies with the time is the only reason to be successful in any field. Though adopting new technologies need some initial investment but their future return can compensate all those investments in very quick time. The time aspect is generally avoided during most of the construction projects which further leads to great loss if there is a delay because of the huge bank loans. This is the main reason for adopting fast-track techniques. Fast-track techniques eventually result in low-cost housing as it saves time. The new innovations and better techniques which can save both money and time without affecting the strength can be used as a replacement for conventional methods. Formwork which is the basic element in any construction project is one of the aspects where new techniques can be implemented for cost cutting in a long run. Conventional formwork which is less durable can be replaced with aluminum formwork (ALUFORM), Tunnel formwork and plywood formwork. There is a huge loss of material, time, labor and money in conventional formwork which results in increasing total cost. The new technologies of formwork results in pouring concrete simultaneously in walls, beams, slab in a monolithic way. The rapid wall is an Australian technology further researched by IIT MADRAS which is also known as Glass fiber reinforced gypsum (GFRG) is a very effective way of achieving fast-track construction. GFRG is a great example of green construction as it uses waste gypsum as the main product and reducing the carbon footprint from the construction industry. This concept promotes modular housing which saves both time and money. Expanded polystyrene (EPS) can also be replaced by conventional formwork which will lead in achieving low cost and fast-track development. The proper planning and management of all these new technologies will help in achieving great results. Use of these fast-track technologies can prevent pollution, reduce the energy consumption, increase their reusability, recyclability and achieve sustainability.

ii) AIM

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The main aim of the study is to compare all these latest technologies on various aspects to find the best possible alternative to the conventional methods for achieving affordable housing in a fast-track manner.

iii) THEORETICAL CONTENT AND PROCEDURE

1. TUNNEL FORMWORK

- ADVANTAGE OF TUNNEL FORMWORK

The implementation of this technique was started from France and due to its encouragement in time-saving, material saving and manpower saving make its step to enter in all over the world with great response. This box shape formwork technique gives us an opportunity to get a good strength by pouring concrete in a single go (monolithic way) to the whole floor (including beam, column and slab) without using massive manpower and saves material wastage. Though its cost is unbearable for any construction site, reusability makes it efficient to go with this technology.

- PROCEDURE OF TUNNEL FORMWORK

Adopting proper step by step procedure makes a huge difference in any construction process in terms of time saving and hence achieving fast-track construction. The procedure to be adopted in tunnel formwork is given as -

Use of this new technique and adopting its procedure which is more definite and properly planned can help in achieving more benefits from this technology if proper steps and their time duration for construction are followed.

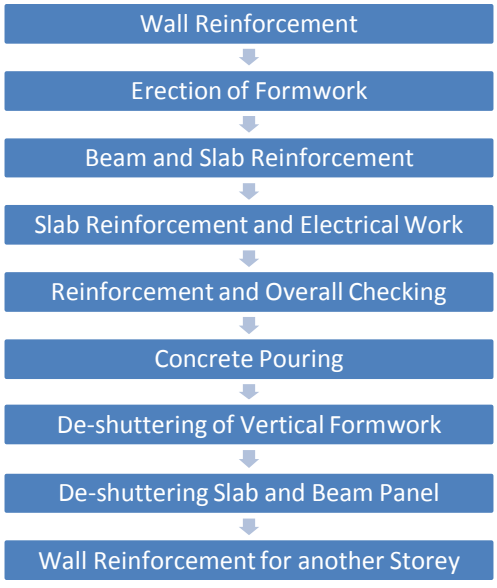
2. ALUFORM

- ADVANTADE OF ALUFORM

Improvisation in any technique makes system more efficient than the preceding one. The replacement in material is done by substituting the conventional steel formwork by the aluminum formwork which is much lighter than steel and has a reusability cycle much more than that of steel. The light weight is also one of the reason for using ALUFORM. Its cost, ease of usability and reusability cycle makes it more preferable for construction of low-cost houses. The scrap value is also primary factor which is much more than conventional system.

- PROCEDURE OF ALUFORM

The procedure to be adopted in Aluform is given as -



3. EPS

- ADVANTAGE OF EPS TECHNOLOGY

EPS (expanded polystyrene) is one of the latest innovations that today's construction industry can look towards. This material is the result of polymerization of monomer Styrene which is far lighter than other material and due to its light weight it can be easily transported and hence directly influence the overall cost of the project. The modifications

which are done for the fitting purpose of plumbing and electrical appliances are very easily done by the hot air gun. It's light weight makes it very different from the other formwork and due to this it becomes very conveyable to labors. The sheet is fixed with wire mesh on both the sides to make it durable in any condition.

- PROCEDURE OF EPS TECHNOLOGY

The procedure to be adopted in EPS is given as -

4. GFRG

- ADVANTAGE OF GFRG TECHOLOGY

GFRG(GLASS FIBRE REINFORCED GYPSUM), the amalgam of gypsum, reinforced by glass fiber makes it a long lasting combination of waste material which gives the great results in all the major aspects concerned with the construction industry. The application of concrete along with iron reinforcement in every third cavity strengthen its durability and overall strength to get a step forward towards constructing the skyscrapers rather than using it only on the small scale projects. GFRG is very economical and that is why it is adopted in most of the developed countries.

- PROCEDURE OF GFRG TECHNOLOGY

The procedure to be adopted in GFRG is given as -

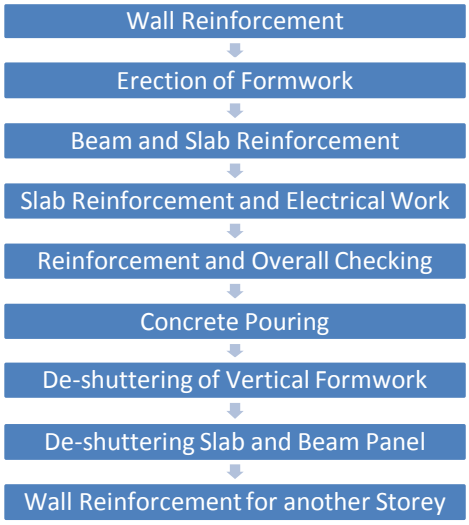
5. PLYWOOD

- ADVANTAGE OF PLYWOOD FORMWORK

It is an ancient technique but still in use in some areas due to their cheap rates. The saving as compared to conventional steel technique is less but it varies depending on area. The tribe where wood is in abundance this technique can be very economical than others. The implementation of this technique in today's time is very difficult because of the scarcity of trees in the some countries but can be implemented where there is abundance of trees.

- PROCEDURE OF PLYWOOD FORMWORK

The procedure to be adopted in plywood is given as -



iv) COMPARISON

On the basis of different experimental studies conducted, information gathered and data collected from different sources, the following table is formed which basically represents the comparison between ALUFORM,TUNNEL FORM,EPS,PLYWOOD FORMWORK,GFRG with conventional technique. The comparison of these technologies on the basis of different parameters is represented below:

CRITERIA	ALUFORM	TUNNEL FORM	EPS	PLYWOOD FORM WORK	GFRG	CONCRETE BLOCK/CONVENTIONAL
Concrete saving	20%	20%	20%	20%	40-50%	-
Steel saving	3%	3%	3-5%	3%	30-35%	-
Brick requirement	20-30%(required)	20-30%	No	20-30%	No	No
Wall panel	No	No	No	No	Yes	No
Initial investment (per sq. m)	$140	$695	$16-$23	$48	No	$60
Time saving	Consume time	65%	40%	Consume time	70%	Consume time
Labour needed	Less	Very less	Very Less	Less	Very less	More
Suitable for high rise (in storeys)	Up to 25	Up to 50	Up to 15	Up to 25	Up to 8	Up to 50
Special machinery	No	Yes	No	No	Yes	yes
Eco-friendly	Less	Less	More	Less	More	Very less
Form work repetition	150-250 (times)	800-1000(times)	-	10-20(times)	-	50-80(times)
Accuracy in work	Good	Good	Very Good	Good	Best	Good
Staff on site (Engineers)	More	Less	Less	More	Moderate	more
Safety	Safe	Precautions needed	Very safe	Safe	Precautions for cranes	Precautions needed
Conveyance to site	Easy	Very difficult	Very easy	Easily	Easily by loading trucks	Easily
Difficulty in installation	Easy	Difficult to put in position	Easy	Easy	Moderate	Difficult
Application	Wall, column, beam, slab	Wall, slab	Wall, slab	Wall, column, slab, beam	Wall, slab	Wall, column, slab, beam
Plastering need	Yes	Yes	Yes	Yes	No	Yes
Availability of form work and material	Easily available	Very difficult	Easily available	Easily	Difficult	Easily
Capability of projects	Large projects	Very large projects	Medium projects	moderate	Very small projects	Large projects

v) CONCLUSION:

This paper could be used as a reference for comparing new technologies to achieve fast-track housing in affordable manner. The paper also concludes the preference order on the basis of some basic parameters given below:

- on the basis of the size of projects :

1. Tunnel
2. Aluform
3. Conventional

- On the keystone of cost effectiveness:

1. GFRG
2. Tunnel
3. EPS

- on the basis of initial investment :

1. GFRG
2. EPS
3. Plywood

- on the basis of accuracy in work :

1. GFRG
2. Tunnel
3. Aluform

- on the basis on material saving :

1. GFRG
2. EPS
3. Tunnel

- on the basis of environment friendly :

1. GFRG
2. EPS
3. plywood

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