COMPARATIVE STUDY OF VARIOUS CONSTRUCTION TECHNIQUES

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ABSTRACT*: Recent trends in construction become indispensable within the coming years to emphasize on sustainable development. The paper discusses the importance and scope of recent trends in construction techniques. The paper emphasizes on exploitation differing kinds of materials in morden trends and for effectiveness in infrastructure building for fast economic process and development of a nation exploitation recent advancements within the field of construction technology. Nowadays, the prefabrication and automation trade construction industry in developed countries has improved the standard of the construction industry. Aluminium Formwork System is a construction system for forming cast in situ concrete structure of a building. The concept of formed (also called "prefabricated") construction includes those buildings wherever the bulk of structural parts are standardized and created in plants during a location far from the building, so transported to the location for assembly.*

Keywords: Precast, Aluminium Formwork, Delay, Quality, Safety

1 INTRODUCTION:

The System is fast, simple, adaptable and very cost effective. It is unique because it forms all of the concrete in a building including walls, floor slabs, columns, beams, stairs, window hoods, balconies and various decorative features in exact accordance with the architects' design. The dimensional accuracy of the concreted work also results in consistent fittings of doors and windows. The smooth–off form finish of the concrete eliminates the need for costly plastering.

Aluminium Formwork System provides Aluminium Formwork for RCC load bearing or RCC framed multi-storied buildings and enables the walls and slabs to be poured in the same operation. These increases efficiency and also produces an extraordinarily strong structure with excellent concrete finish. Due to the fine tolerance achieved in the machined metal formwork components, consistent concrete shapes and finishes are obtained floor after floor. This allows plumbing and electrical fittings to be prefabricated with the certain knowledge that there will be an exact fit when assembled.

The concept of precast (also known as "prefabricated") construction includes 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. The main features of this construction process are as follows:

- The division and specialization of the human workforce
- The use of tools, machinery, and other equipment, usually automated, in the production of standard, interchangeable parts and products

This type of construction requires a restructuring of the entire conventional construction process to enable interaction between the design phase and production planning in order to improve and speed up the construction.

2 LITERATURE REVIEW

Delays[1]

Delays happen in most construction project; it could be defined as time overrun either beyond completion date specified in contract or beyond the date that parties agreed upon for delivery of project. The project time overrun and cost overrun problem is faced by numerous countries and the study on the causes of these problems is also conducted such as India.[2] In most construction projects, best possible performance are unachievable with poor productivity resulting in time overrun and consequently cost escalation of the projects.

Types of Delays

According to Menesi (2007), delays are classified into two different types according to liability: excusable and inexcusable (Fig. 1).

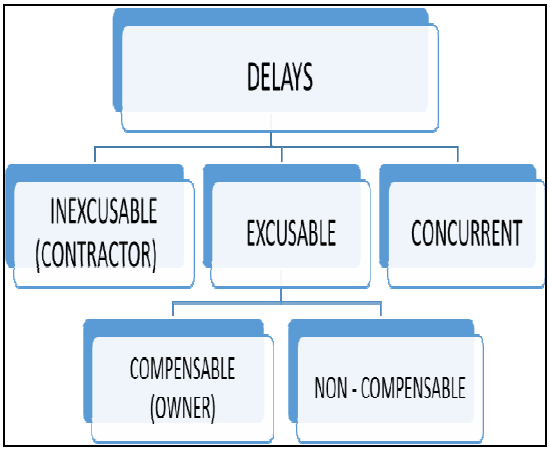

Fig. 1 : Types of Delays

Delays that affect project completion date as agreed on contract are considered as critical delays, while delays that do not affect project completion date are known as non-critical delays. An excusable delay is beyond the contractor control i.e. delay due to unforeseeable activity beyond the contractors or the sub-contractors control. Excusable delays without compensation are delays caused by neither the client nor the contractor. Non-excusable delays (NEDs) are within contractor control. NEDs are the responsibility of contractor and the client may be entitled to claim the damages.

Only excusable delay can be compensable delay. A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation. Under non-compensable delay the contractor is not entitled to any compensation resulting from the excusable delay.

When the same type of delay happens more than one time, either alone or consequently, impact the projects critical activity schedule, a concurrent delay occurs. The concurrent delay can also be classified as:

Table -1: Classification of concurrent delay according grant to the contractor

Delays that occur concurrently	**Entitlement to the contractor**
Excusable and **non-excusable**	Only time extension granted
Excusable with compensation and excusable without compensation	Entitled to time extension but not to damages
Two excusable with compensation	Entitled to both time extension and damages

Quality[3]

As the market economy has developed, market competition has had an important role of the law of survival of the fittest in every corner. The pressure of construction enterprises from the market and competitors will be greater and greater, as well as the increasing requirements of customers of quality assurance, which require the construction companies to improve their internal quality, strengthen management, in particular, pay close attention to quality control.

Quality is the symbol of human civilization, and with the progress of human civilization, quality control will play an incomparable role in the business. It can be said that if there is no quality control, there is no economic benefit. Construction projects are an extremely complex process, involving a wide range. There are plenty of factors affecting the quality of construction, such as design, materials, machinery, topography, geology, hydrology, meteorology, construction technology, methods of operation, technical measures, management systems, and so on. Because of the fixed project location, large volume and different location of different projects, the poor control of these factors may produce quality problems. During controlling the whole process of construction, only accord with the required quality standards and user promising requirements, fulfilling quality, time, cost, etc., construction companies could get the best economic effects. Construction companies must adhere to the principle of quality first, and insist on quality standards, with the core of artificial control and prevention, to provide more high quality, safe, suitable, and economic composite products.

Economic Impact of Accidents[4]

Many owners and contractors still believe the myth that safety concerns will lead to greater cost and reduced productivity. The reality is that safety evaluation and control save money. The delays and total expenses following an accident are usually much higher than the original cost of establishing and maintaining safety standards. The costs associated with accidents and fatalities are as follows:

(a) Direct Costs (Insured):

- Human ill-health, injury, death
- Medical and hospital expenses
- Transportation for first aid, and for medical treatment
- Property damage, destruction
- Liability insurance costs (after workers compensation)
- Repair and replacement expenses

(b) Administrative Costs:

- Budget allocations must be made for
- Safety director / coordinator
- Equipment and supplies
- Time (meetings, inspections, etc.)

(c) Indirect Costs (Uninsured):

- Impact on public, neighbourhood
- Delay due to accidents, investigations
- Wages to injured worker for time not worked
- Loss of crew efficiency
- Training new/substitute worker
- Clean-up, equipment repair, stand-by

- Rescheduling work
- Post-accident extra safety supervision
- Construction authority and civil fines
- Legal fees
- Impact on profession, industry
- Reputation of government

Importance of Safety[5]

In any profession, the need for safety is paramount, because of the following:

- Humanitarian concerns
- Professional, institutional, and social concerns
- legal and regulatory concerns
- Economic concerns

In construction industry, safety is even more critical than in other industries. Every nation must take construction health and safety quite seriously, because the accident and fatality (death) rates in this industry are among the highest in most countries around the world, including the advanced nations.

These statistics should be of great concern to the nations presently under high risk in the construction industry. Apart from loss of limb and life, damage to property and waste of time, the reputation of the profession and of the country itself are at stake.

3 PRECAST[6]

Precast Concrete Technology, the so called unconventional method in an Indian Space can facilitate both speed and quality of the construction and at the same time exploits the advantages that these large scale projects offer in terms of volume turnover and the repetitions. With the changing face of realty sector in Indian market, the change of construction methodology is inevitable. This paper aims at demonstrating how the Precast Concrete Technology can be efficiently and effectively used on various Indian Projects in the light of Project sunder execution.

The Design

While designing precast elements following should be considered.

1. Loads 2. Lifting from Casting Beds 3. Precast elements size 4. Reinforcement in design	5. Light weight panels 6. Lifting inserts & clutches 7. Bracing design 8. Anchoring Brace

Safety

Safety of the work force at production unit as well as site is should be on top most priority. Work force must be either well experienced and or well trained and should be aware of the nature of pre- cast work they are going to handle.The firm safety management policy should be adequate enough to deal with any emergency and hazardous situation.

Pre - Production program

The appropriate method of pre cast production will be developed considering following.

1. compliance with architectural and structural requirements 2. Building Stability 3. Erection platform 4. Appropriate handling system 5. Design and approval from the client's consultant	6. Concrete mix design and strength criteria 7. Propping and Supporting Details 8. Lifting and handling stresses 9. Location of lifting inserts 10. Stability and buckling

Manufacture

Manufacturing requirement can have a direct bearing on the safe handling, transportation and erection of precast concrete components.

Following elements should be considered and customized

1. Moulds 2. Surface finishes 3. Assembly and Release Details 4. Suction and /or Friction 5. Tilting Moulds and Vertical Moulds 6. Concrete quality 7. Minimum, strength for lifting 8. Lifting inserts and anchors in mould	9. Type of lift requirement 10. Stacking and storage 11. Minimum strength for Transport and Erection 12. Reinforcement 13. Dunnage 14. Creep 15. Quality assurance and Certificate of Compliance

Transportation, Handling and Erection

The most challenging task is erection at site. Following should be considered.

1. Trucks 2. Transporting systems 3. Erection platform 4. Erection preparation 5. Rigging 6. Cranes	7. Erection Sequence 8. Erection of Tilt-up panel 9. Erection crew 10. Leveling Shims 11. Fixing inserts 12. Propping for floor Erection

Post Erection

In the Last stage of pre – cast erection following should be considered:

- Checking with architectural and structural requirements
- Joints and sealant
- Checklist for latent or patent defect.
- Approval from client and consultant

Advantages:

- Tackling the skills shortage.
- An easier method of compliance to building standards.
- The ability to achieve high standards, including high thermal and acoustic performance.
- A reduction in waste materials, with a larger incentive for suppliers to reduce waste.
- Shorter build times.
- A better quality construction in finish with fewer defects.
- A reduction in both accidents and health concerns.
- Reduced life-cycle costs
- Increased accuracy on completion dates
- A more simplified procurement process
- Reductions in CO2 emissions.
- Increased on-site productivity
- Generally increased 'value' of products.

Disadvantages:

- Increased risk and the industries reluctance to change.
- The lack of published codes and standards.
- The lack of local availability of the materials.
- The lack of experience of the construction process and the materials.
- Difficulties obtaining finance.
- Insufficient worker skill.
- Difficulties in achieving economics of scale.
- The fact that the quality and durability of the techniques over time have not been proven.
- Difficulties integrating MMC's with traditional works.
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4 ALUMINIUM FORMWORK[7]

- The speed of construction by aluminium formwork system will surpass speed of most of the other construction technologies.
- The work manages aluminium lightweight formwork approach effectively in order to accelerate the particular development, to reassure quality manage along with strength. Adoption of this system reduces overall cost of the structure.
- This is one of the systems identified to be very much suitable for Indian conditions for mass construction, where quality and speed can be achieved at high level.

Technology

Aluminium Formwork System is highly suited to load bearing wall construction whereas traditional formwork consisting of plywood and timber is not suitable to the high pressures of fresh concrete on the wall.

Cost: Use of this formwork in load bearing design gives an average of 15 per cent cost saving in the structure of the building and increased usable floor space of 8 per cent over RCC design.

Time: For 100 per cent work, construction through slab beam wall construction takes X time and through Aluminium Formwork technology the time required is 1/6th of the X time.

Environment Friendly: The technology is environment friendly as there is no use of timber. The formwork gives the box or cellular design resulting in the walls giving support to the super structure in two directions. As a result, the structures are more resistant to earthquakes than the traditional RCC column and beam designs.

Lifting: As the Aluminium Formwork is lightweight, no tower cranes are required for the same unlike in tunnel framework.

Labours: Due to simplicity of the assembly, only unskilled labours are required with minimal supervision.

Repetitions: The Aluminium Formwork System is removable and can be reused hundreds of times with little maintenance.

Scrap Value: Moreover, the requirement of steel is also reduced in this technology as aluminium has a higher scrap value.

Simple Assembly Systems

Pin and Wedge System

The panels are held in position by a simple pin and wedge system that passes through holes in the outside rib of each panel.

Quick Strip Prop Head

One of the principal technical features which enables this speed to be attained using a single set of formwork panels is the unique V shaped prop head which allows the 'quick strip' to take place whilst leaving the propping undisturbed. The deck panels can therefore be reused immediately.

Speed

The in-situ construction of all walls and partitions reduces the requirement for follow-on wet trades.

The concrete surface finish produced with the aluminium forms allows achievement of a high quality wall finish without the need for extensive plastering.

Doors and windows are formed in position, with this high degree of precision items such as door and window frames can be directly installed on site with minimal re-sizing required.

Quality

High quality Aluminium Formwork panels ensure consistency of dimensions.

On the removal of the Formwork mould, a high quality concrete finish is produced to accurate tolerances and verticality.

The high tolerance of the finish means that no further plastering is required.

Importance of the Aluminium Form work System[8]

Rapid urbanization has resulted in a geometric increase in the housing demand, which cannot be

fulfilled using conventional materials and methods of construction. The traditional or conventional method of construction for mass housing & high rise buildings is comparatively, a slow process and has limited quality control, particularly when a large size project is involved. It is therefore obligatory to work out a method or a scheme where the speed and quality of construction are controlled automatically by a systematic approach. Therefore Aluminium Formwork System (AFS) identified to be suitable for Indian conditions for mass housing construction where quality and speed can be maintained at a reasonably high level

5 CONCLUSION:

In this research paper I have introduce various construction techniques i.e. conventional construction, precast construction and aluminium formwork. it is observed that in conventional construction time, cost, quality, safety, economy, etc. became major constraints. which should be eliminated the further work will be extended over comparative study between conventional construction techniques and two of the modern method of construction which are (1) Precast construction (2) aluminium formwork.

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