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A Review on Advanced Construction Techniques

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A B S T R A C T

This paper shows that, the construction industry is repeatedly criticized for being in-efficient and slow to innovate. The basic methods of construction, techniques and technologies have changed little since roman times. But the application of innovation in the construction industry is not straight forward. The term "advanced construction technology" refers to a broad variety of contemporary technologies and techniques, including the most recent advancements in structural analysis and design, quantity surveying, design processes, facilities management, services, and management studies.

OBJECTIVE

To study different methods of construction to successfully achieve the structural design with recommended specifications.

Keywords: Advanced construction technology, construction industry and innovations

1. INTRODUCTION

Now-a-days the construction technology and equipment become very advanced, including different materials in the construction world, additional equipment, different types of machinery, etc. It has become vital to keep up with neighboring nations' infrastructure growth in this competitive globe. All of these contemporary solutions assist in lowering supplemental costs, labor costs, transportation costs, material longevity, and many other costs.
Below is discussion of a few of these construction techniques.

1.1. Underwater construction

We must choose underwater construction while building bridges, dams, or any other structure where the foundational portion is likely to be submerged. Building on water presents various challenges, particularly in locations where the depth is great. Our first goal during underwater construction is to provide a dry, water-free environment so that we may work without endangering the structure's structural soundness.
The underwater construction techniques are classified into two types. They are:

a. Construction techniques.
b. Methods of placing of concrete.

a. Construction techniques

These construction techniques are:

i. Caissons

These are the structures used in underwater construction work; they have an airtight chamber that is open at the bottom and filled with air at a pressure high enough to keep water out.In this, the caissons are sub-divided into three types. They are:

- **Box caisson**

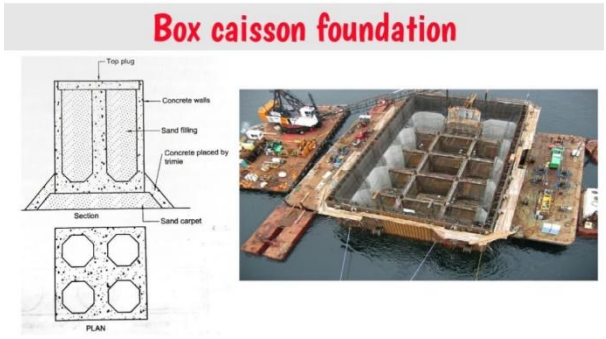

Fig -1 Box Caisson Foundation

- **Open caisson**

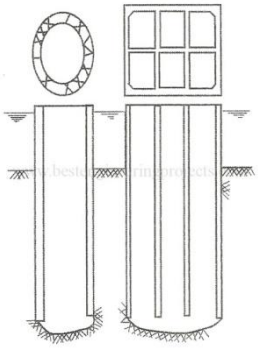

Fig 2 Open Caisson

- **Pneumatic caissons**

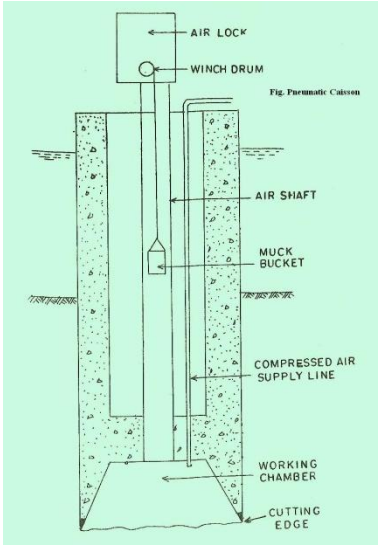

Fig 3 Pneumatic caissons

ii. Cofferdams

A cofferdam is a form of watertight building used to facilitate building projects in often submerged regions, such bridges and piers.
In this, the cofferdams are subdivided into 6 types. They are:

- Cantilever sheet piles
- Braced cofferdam

- Double wall cofferdam
- Cellular cofferdam
- Earth embankment
- Rock fill cofferdam

b. Methods of placing of concrete

The methods are classified into four methods. They are:

- Tremie method
- Toggle bags
- Pump method
- Bag works

1.2. Flat slabbing technology

This technique instantly creates flat slabs that enable the quick and simple placement of horizontal partitions by utilizing the simplicity of contemporary formwork. Prefabricated services are used to their fullest extent since uninterrupted service can be provided in areas beneath floor slabs. Internal layouts are used by every top-tier building Construction Company since they can be quickly altered for accepting alterations later. Additionally, because less reinforcement is needed, labor costs are greatly decreased. Most floor configurations, including uneven column arrangements, curved floor shapes, ramps, etc., are suitable for flat slabs. Flach slots offer a minimum depth solution, quick construction, flexible plan layout (depending on shape and layout), a level soffit (clean finish and layout-free), and room for the using aerial shapes. The adaptability of flat slab construction can result in cost savings while still allowing the architect a great deal of creative freedom.

Fig 4 Flat slabbing Technology

1.3. Tunnel formwork system

Using this tunnel technique, construction of cellular buildings with repeating patterns can be completed more quickly by fabricating monolithic walls or units in a single operation each day. Quick work is possible because to the utilization of formwork and ready-mix concrete as well as the comfort and agility of industrial environments. On the working site, cranes are used to stack and employ tunnel formworks.

The daily-cycle formwork procedure enables the contractor to cast slabs and walls simultaneously. It combines the efficiency, precision, and speed of on-site construction with the adaptability and cost-savings of off-site construction. This quick technology dramatically reduces construction time as compared to conventional methods. The Tunnel Form System reduces the cost of finishing and M & E while enhancing the speed, quality, and precision of concrete construction. Thanks to modern methods for making steel formwork, tunnel forms are strong and durable. The technique produces effective load-bearing structures that are known for withstanding earthquakes.

Fig 5 Tunnel formwork system

1.4. Precast flat panel modules

These are wall and floor modules that were created off-site and then transported for installation to the construction site. This method can also be used to create load-bearing elements like ornamental cladding and insulating panels. The method, also known as cross-wall construction, has grown in popularity because of how well it adheres to specifications and how simple and quick it is to build.

The PFP system involves producing various structures, such doors, windows, walls, and floor units, at a factory before transporting them to the construction site and erecting them there. Since it offers quality and effectiveness and enables quick on-site erection, this technology is perfect for recurring projects.

Fig 6 Precast flat panel modules

1.5. 3D volumetric construction

Using this modular construction method, 3D modules are produced in controlled industrial conditions using appropriate building and construction materials. For assembly, finished units are delivered to the site in a variety of modules, including unfinished units with all amenities installed or simple structural blocks. When blocks are immediately assembled on site, the properties of concrete, such as fire resistance, sound resistance, and thermal mass, are maintained.

This technique can be used to build permanent (and occasionally temporary) constructions including homes, offices, schools, hospitals, and other such facilities. It assists in striking a balance between the three elements of a typical building project: time, quality, and money. In other words, volumetric architecture excels when a structure must be built quickly, to a high standard, and affordably.

Fig 7 3D volumetric ocnstruction

1.6. Thin joint masonry technique

This method decreases the amount of mortar poured by decreasing the mortar's depth from 10mm to less than 3mm. As a result, the more extended wall panels may be covered with mortar fast and effectively, enhancing production. With large-sized concrete blocks, greater building efficiency and significant cost savings can be achieved. Because the mortar hardens fast without weakening the bonding, which eliminates the floating issue, additional mortar courses can be installed in a single day.

In the UK, this building method is becoming more well-liked. In many European nations, it has already made up to 90% of all masonry construction. Moreover, the benefits of this rapid, easy, and highly efficient construction method will become more and more obvious as building standards change and technical and environmental requirements increase. Builders that desire to maximize a building's thermal performance and reduce CO2 emissions over the course of the building's lifetime while keeping the comfort, familiarity, stability, and long-term solidity of a masonry structure can do so with thin-joint construction.

Fig-8 Thin joint masonry technique

1.7. Hybrid concrete construction

The quality is doubled, the building period is cut in half, and total costs are reduced thanks to this hybrid of pre-casting and in-situ casting. It is favoured by individuals looking for exceptional quality at a reasonable cost. The building is durable and dependably effective. Construction becomes more affordable while improving in quality. Hybrid concrete structures are straightforward to build, competitive, and consistently effective.

Even if a building's structural frame only contributes 10% to the overall cost of construction, the material used for the frame has a big influence on subsequent procedures. A sizable amount of the work for a hybrid concrete building project is handled by the precast factory. Each safety plan is customized since hybrid concrete construction is utilized on the project's site.

Fig-9 Hybrid concrete construction

1.8. Insulating concrete framework

As the name suggests, this method insulates a building's wall with expanded polystyrene panels before filling it with concrete to produce an impenetrable construction. While the concrete provides excellent wall strength, the polystyrene guarantees that heat is trapped inside.

Fig 10 Insulating concrete framework

1.9. Precast foundations

The foundations of buildings are built using this approach, with concrete piles acting primarily as a source of strength before being joined to form the foundation's shape. All of this occurs in a manufacturing environment that is controlled and constantly monitoring.

Fig 11 Precast foundations

2. EQUIPMENT USED FOR CONSTRUCTION WORKS

The equipment with proven utility in building construction may be as listed below:

- Chain and pulley block
- Grouting pumps
- Sprayers for painting work
- Portable drilling hand machines
- Horizontal trolleys and wheel barrows
- Pumps
- Vibrators for compaction of concrete
- Sand washing machine
- Vertical lifts, hoists, and winches
- M.S. tubular scaffolding and formworks
- Concrete mixers
- Cranes
- Earth excavators
- Earth-movers

3. ADVANTAGES OF ADVANCED CONSTRUCTION TECHNIQUES

- Its savings the time for total project work.
- Breaking of concrete brick is avoided, which saves labor time and reduces the requirement of skilled labor.
- It controlled the quality of the final product.
- Better curing and higher strength due to mechanization.
- It saves space for raw material stacking.
- It increases in construction speed due to symmetrical and simple joining methods.
- The dependability of the activities can be neutralized and most of the activities can be taken up simultaneously.

4. CONCLUSION

All of these are helpful in accelerating and making construction activities more affordable. Saving money and using it wisely for other investments has been essential since the outbreak. Additionally, there are several approaches that can be used in construction projects. These complex approaches may initially be expensive, but over time they will prove to be cost-effective as maintenance and other ancillary costs decrease. Therefore, it is the civil engineer's primary duty to use resources like time and money as effectively as possible.

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