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OVERVIEW OF INNOVATIVE SLIP FORMWORK FOR STRUCTURAL MEMBERS

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Abstract: Vertical expansion is the ideal resolution to meet the demand of land for the fast growing urban people in India. It is the production of tall structures such as high-rise buildings, skyscrapers and sky towers etc., rather than constructing laterally to accommodate large people in quiet a smaller area. The rapid improvements in the field of formwork, along with the modernizations in concrete as a material has led to an innovator change where safer, faster, and workable and more construction that is proficient is possible these days. Results highlight the significance of advanced high-rise formwork systems in streamlining the workflow of concrete and other downstream activities, permitting for better resource allocation, more waste reduction, smaller work batches, less inventory, and safer working environment.

Keywords: Concrete, Formwork, Panel, High-Rise building, Slab

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INTRODUCTION

When concrete is placed, it is in a plastic state. It requires to be supported by temporary supports and casings of the desired shape until it becomes sufficiently strong to support its own weight. This temporary casing is known as the formwork or forms or shuttering. [1]. In ancient time the formwork is used, some of the earliest examples of concrete slabs were built by Roman engineers. Because concrete is quite strong in resisting compressive loads, but has relatively poor tensile or torsion strength, these early structures consisted of arches, vaults and domes. [1]. Formworks are generally made by wood, steel, aluminium or prefabricated forms into which the concrete is poured. The formwork used to cast the structural elements such as, columns, beams, slabs and shear walls also used for smaller parts of building such as stairs, etc. Selection of formwork in high-rise building is depend upon, the main factors such as cost, time and quality. [2]. The most important factor in terms of cost, quality and speed in a high-rise building construction project is the type of the formwork used in the project. With the advancement of technology, it developed gradually, people used ply wood sheets instead of timber planks, and steel pipes with jacks were used to support the plywood. [6]. For instance, crane-lifted formwork used for core wall erection can congest the crane schedule and consequently delay the delivery of materials to other site zones. Whereas, self-climbing formwork release the crane schedule and can be reused for other critical activities. Another important factor that affects the progress of work is the resulting quality of cured concrete. Concrete repair consumes a significant amount of time and affects the speed and quality offinishing works that follow. [3]



Fig. 1: Conventional Formwork System[7]

REQUIREMENT OF GOOD SLIP FORMWORK

- **Containment:** formwork must be capable of shaping and supporting the fluid concrete until it cures.
- **Strength:** formwork must be capable of safely withstanding without distortion or danger the dead weight of the fluid concrete is placed on it, labour weight, equipment weight and any environmental loadings.
- **Resistance to leakage:** all joints in form work must be either close fitting or covered with form tape to make them grout tight. If grout leakage occurs the concrete will leak at that point. Leakages cause honeycombing of the surface.
- **Accuracy:** formwork must be accurately set out so that the resulting concrete product is in a right place and is of correct shape and dimensions.
- **Ease of handling:** form panels and units should be designed so that their maximum size does not exceed that which can be easily handled by hand or mechanical means. In addition, all formwork must also be designed and constructed to include facilities for adjustments, levelling, easing and striking without damage to the form work or concrete.
- **Finish and reuse potential:** the form face material must be selected to be capable of consistently imparting the desired concrete finish (smooth, textured, featured or exposed aggregate etc.) At the same time, it should also achieve the required number of reuse.

- **Access for concrete:** any formwork arrangement must be providing access for placing of the concrete. The extent of this provision will be dependent on the ease of carrying out the concrete operations.
- **Economy:** all the formwork is very expensive. On average about 35% of the total cost of any finished concrete unit or element can be attributed to its formwork; of this just over 40% can be taken for material for formwork and 60% for labour. The formwork designer must therefore not only consider the maximum number of times that any form can be reused, but also produce a design that will minimize the time taken for erection and striking.

MATERIALS AND DESCRIPTION

➤ TIMBER

Timber is a popular formwork material. It has been using from ancient age. We can make concrete formwork using only timber or combining timber with other types of formwork material. Timber is light weight, easy to fix and remove. It's also economical and available in different sizes. The formwork is built on site out of timber and plywood or moisture-resistant particleboard. It is also the most flexible type of formwork, so even where other systems are in use, complicated sections may use it.



Fig. 2: Timber Formwork[8]

➤ STEEL

Steel formwork materials are costly. But it has many times re-usability. It's mainly useful for construction company where repeated uses are possible. Steel formwork materials give excellent finishes to concrete surface. Mostly used in large construction projects or in situations where large number of re-uses of the same shuttering is possible. Suitable for circular or curved shaped structures such as tanks, columns, chimneys. Etc. & for structures like sewer tunnel and retaining wall.



Fig. 3: Steel Formwork[9]

➤ PLYWOOD

Plywood is an artificially manufactured wooden material used for making concrete formwork. It is strong, durable and light weight. The availability of different thickness plywood in the market makes it popular for different sizes concreting work. The thickness range of plywood is, from 7 mm to 32 mm. The standard size of plywood mostly used in building construction is 1220 x 2440 mm. It can easily be cut into any size. Plywood is used extensively for formwork for concrete, especially for sheathing, decking and form linings. There are two types of plywood - internal and exterior. The interior type is bonded with water resistant glue and exterior type is bonded with water proof glue.



Fig. 4: Plywood Formwork[10]

➤ ALUMINIUM

Aluminium formwork is getting popular in construction industry. It is easy to fix and remove thus increase worker productivity. It is also many times re-useable. As the strength of aluminum in handling, tension and compression is less than the strength of steel, it is necessary to use large sections.



Fig. 5: Aluminium Formwork[11]

➤ PLASTIC

These forms have become increasingly popular for casting unique shapes and patterns being designed in concrete because of the excellent finish obtained requiring minimum or no surface treatment and repairs. As per experts, depending on the plastic quality, it can be used up to 100 times. The core advantage of this is, it is super lightweight, easy to handle and stack.



Fig. 6: Plastic Formwork[12]

CONCLUSION

Systematic and detailed introduction to the critical innovative construction technologies are introduced based on knowledge and practice. These technologies are expected to utilize great influence on similar projects. Application of these technologies can be made in the construction of high-rise buildings in the future. The adaptability of different formwork systems over the intricacy factors associated with the construction of high-rise buildings.

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