

A Critical Study on Technological Advancements of Formwork in Construction Project Management

Israth Ansari Shaik, B.G. Rahul

Abstract: Nowadays due to the globalization has brought a lot of changes in the ways of construction across the globe because the spread of newer and innovative technologies across the communities in the world has become simple and the cross-border knowledge sharing has become faster and accurate. Formwork, which temporary structure, help in mounding of concrete into desired shape Support the loads imposed on it holds as well as underpins wet cement till the time it fixes, is a critical component in development. This investigation plans to look at benefits and negative marks by utilizing a regular timber Formwork framework, Re-Usable Plastic /PVC/Aluminum Formwork System, Table Form/Flying Form systems, Jump Form System Slip Form Systems and Permanent Insulated Formwork Systems in the construction industry in developed countries has improved the standard of the construction industry. One of the most important factors in the determining understand the recent advancements in the Formwork systems with reference to their technological advantages over the traditional Formwork systems and to compare and analyze the impacts of the advancements in the Formwork systems over the traditional Formwork systems on the construction project management. Form the above problem research has been done, are the rectified results will present in this study. the project quality of the work.

Index Terms: Aluminum Formwork, Jump Form System, Permanent Insulated Formwork, Slip Form Systems, and Table form/Flying Formwork.

I. INTRODUCTION

Formwork may be defined as the temporary structure that helps in mounding the concrete into shape we wanted and helps in holding it in exact size, shape and position till it is hardened properly to bear the loads impended on it. It is an effective means of curing also. The construction industries place a vital role in the development of country. In India, it contributes about 8.3% of national growth GDP. Construction industry involves various resources such as man power, machinery, money, materials. The materials itself contributes 30% of overall cost of the project. Form work is the one of the important material in construction site which affects the quality and safety. There are different types of formwork systems such as conventional timber Formwork system, Re-Usable Plastic /PVC/Aluminum Formwork System, Table Form/Flying Form systems, Jump Plastic /PVC/Aluminum Formwork System which lacks in quality and safety of works. Other technologies such as pre fabrication, table formwork and jump formwork etc...can be

used in construction which improves the quality of the work and decreases the cost of the project. But in India, we are not adopting the above mentioned due to lack of knowledge and lack of skilled labor. Formwork system plays an important role on cost, time and quality in the venture conveyance. Yet at the same time most recent formwork frameworks are hardly any utilizing in India and the majority of the developers don't prefer to pick the ongoing innovation as they have the uncertainty of confronting misfortunes in the venture. At the same, time they believe that these formwork systems are much expensive. This study aims to provide knowledge and techniques on modern formwork systems. Hisham A. AbouIbrahim and Farook R. Hamzeh [1], observed that the Advanced formwork systems provide innovative solutions for today's composite high-rise developments and open the doors for greater advance in construction methods.

Future studies can link the use of advanced systems to the implementation of lean faultless on high-rise projects, such as waste reduction, Takt time calculation, and the use of pull systems and Kanban cards. N. Minea, S.H. Waib, T.C. Limc and W. Kangd[2], observed That The foregoing six project characteristics together with additional three variables such formwork quantity /constructed floor area, (storey height \times constructed floor area), and formwork quantity / (storey height \times constructed floor area) is similarly marvelous -predictors of unit requirement as the dependent variable. Tech Mailer Team -Dr. M Kalgai, Prasad YTVV, Vaishnavi V[3], observed The nature of cement and wellbeing of development to a vast degree rely upon the sort and nature of the Formwork, level of supervision just as workmanship. The requests of development is brought about creative prompting the advancement of various sorts of Formwork types. The specific Engineer needs to pick the specific frameworks, which give increasingly specialized and conservative advantages. it is required to comprehend the protection to be taken while lifting the formwork and setting of the solid. Ininjal M Parekh, bhupendra M Marvadi, umang Patel[4], observed That the pros and cons to the Selection of formwork construction is depending on the project type and project requirements. The formwork construction technique is cost-effective for mass construction and repetitive projects. Formwork construction is rapid construction technique in which construction at high speed. Formwork construction is offering high quality of construction and low maintenance at the minimum cost.

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SwapnaliM. Karke, M.B. Kumathekar [5],observed That They are designed to give expanded precision and limit squander in development and most have upgraded wellbeing and security highlights worked in. The fundamental frameworks being used are Mivan innovation and passage structure. This guide sets out their key highlights process effectiveness, security, supportability and other contemplation so as to help development experts to exploit them to accomplish present day, proficient solid development.

II. RESEARCH SIGNIFICANCE

To understand the recent advancements in the formwork systems with reference to their technological advantages over the traditional formwork systems. To compare and analyze the impacts of the advancements in the formwork systems over the traditional formwork systems on the construction project management. With the advent of every new / innovative technology in the domain of the construction technology will drastically change the traditional project management techniques and tools that are being applied for a specific construction project management. Also the advancements in formwork systems in the recent past have also brought drastic changes in the construction project management. Hence this study is aimed to understand the advancements in the formwork system and their impacts on construction project management.

III. DESCRIPTION OF WORK

A. Methodology

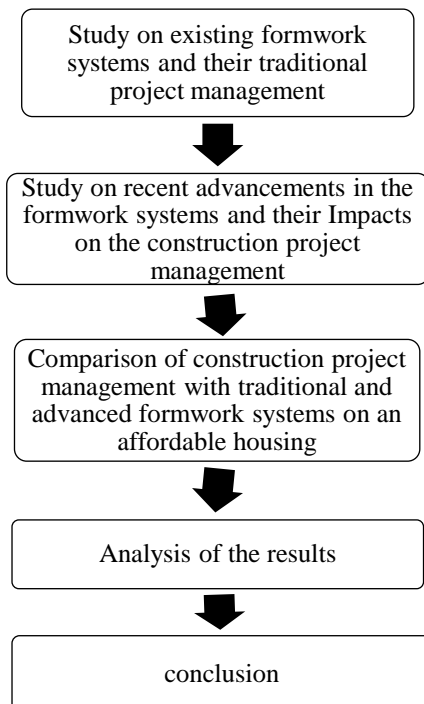


Fig.1 Detailed methodology of project

B. Project Management

Project Management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements PM is the domain that deals with the Construction Project Management (CM), is a professional service that uses specialized, project management

techniques to oversee the planning, design, and construction of a project, from its beginning to its end.

C. Present Scenario of Formwork In India

- Low technology
- Labour vigorous.
- Labour-unskilled, moving, traditional and family oriented
- Lack of monitoring body generally for quality construction.

D. Indian Construction using Formwork

Formwork may be defined as the temporary structure that helps to mould the concrete into shape we required and holds it in the exact size, shape and place till it is hardened sufficiently to bear the loads imposed on it. According to the Indian scenario, there are different types of formwork some are mentioned below:

- a) Timber Formwork
- b) Plywood Formwork
- c) Iron Formwork
- d) Aluminum Formwork

Timber Formwork: For minor construction works, timber (wood) is the best suitable type and commonly usable type formwork materials but will warp, swell and shrink.

Plywood Formwork: Usually for one-time use.

Iron Formwork: For repetitive works.

Aluminum Formwork: Aluminum forms are lighter and can be used repetitively, thus enhance the productivity.

E. Removal of Formwork (As Per IS 456)

In normal conditions where convenient type of temperature does not decrease below 10 degree, Celsius and where normal cement are used and sustainable curing is done. Following by the removal period of formwork might consider satisfying. Table I shows different types of removal of form works.

Table I: Different types of removal of form works

S.NO	TYPES	PERIOD
1	Components in Which Formwork Is Used	18-24 hours
2	Soffit formwork to slabs (props to be re-fixed immediately after removal of formwork)	7 days
3	Soffit formwork to beams	14 days
4	Props to slabs: a)slab spanning up to 4.5m b)slab spanning up to 4.5m	7 days 14 days
5	Props to beams and arches a)spanning up to 6m b)spanning up to 6m	14days 21 days

F. Impacts of Formwork

Formwork takes more than 50% of RC construction time. The cost of formwork varies between 15 to 25% of the reinforcement concrete structure cost.Proper engineered



system formwork should be specified upon in the tender to attain good formwork practice, safe working conditions and to get quality and durable concrete structure. Otherwise it will not only lead. Too poor-quality structures but also wasting resources like materials, manpower and time. Which in turn effects construction delay and cost leap of projects. That affects the balance between safe and unsafe conditions. However, once a failure has occurred investigators will certainly check whether the codal furnishing were followed or desecrate. Non-availability of detailed Indian codes or specifications for formwork should not be an vindicate for improper formwork practices. Formwork practice in India to suit the accessible materials/system and formwork detailed code.

G. Advancements or Modern Formwork Systems

As a result of the efforts to improve the formwork for achieving the construction project efficiencies, the following new systems of formwork have been made possible to best suit to each type of the project, as detailed below

- i. Re-Usable Plastic/PVC/Aluminum Formwork Systems
- ii. Table form/Flying Formwork Systems
- iii. Jump Formwork Systems
- iv. Slip Formwork Systems
- v. Permanent Insulated Formwork Systems (ICF)

Re-Usable Plastic/PVC/Aluminum Formwork Systems:

This kind of formwork can be utilized every now and again to develop diverse sorts of little and substantial developments. These frameworks are secluded in nature interlocking in example to use as examine to different kinds. Houses construction in large numbers (government schemes and residential colony) often use this type of constructions as they are vigorous and light in weight. These helps in both economic and sustainable factors of a high number of repetitions possible.



Source: Flats for NGOs in Amaravati – Capital of Andhra Pradesh with Aluminium Formwork Systems

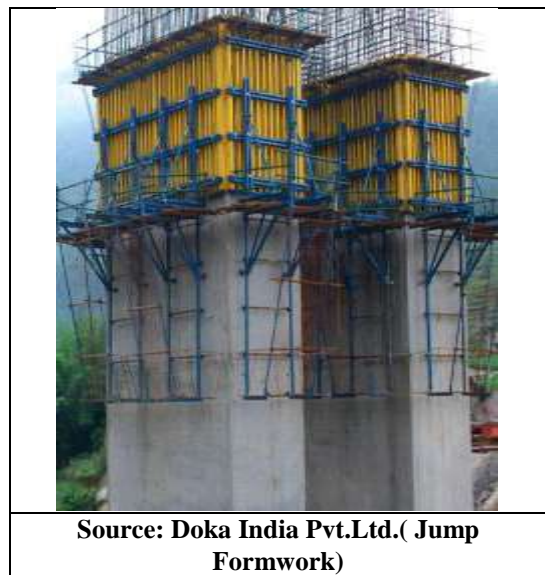
Table form/Flying Formwork Systems: Utilized for lodgings, business structures, Residential pads, workplaces and so on. The framework requires adequate space around

the new development to fly the table unit past the building line on ordinary use. It offers portability and fast establishment for development ventures with customary arrangement formats or long redundant structures and thus is profoundly reasonable for level chunk, and bar and piece designs.



Source: Ramakrishna Venuzia Techno Towers at nearby ANU (Table formwork).

Jump Formwork Systems: Hop structure framework (frequently depicted as climbing structure), is appropriate for development of multi-story vertical solid components in skyscraper structures, for example, Shear dividers, Core dividers, Lift shafts, Stair shafts, and so on. These are developed in an organized procedure.



Source: Doka India Pvt.Ltd.(Jump Formwork)

Slip Formwork Systems: It is a method of vertically extruding a reinforced concrete section and is suitable for the construction of core walls in high-rise structures – lift shafts, stair shafts, towers, etc. It is a self-contained formwork system and can require little crane time through, construction. The formwork rises constantly at a rate of about 300mm every hour, supporting itself on the center. This formwork comprises of three stages. The upper stage fills in as a capacity and circulation territory, the center stage plays out the primary working stage and is at the highest point of the poured solid dimension. The lower stage gives access to solid wrapping up.



Source: Ramakrishna Venuzia Techno Towers atnear by ANU.(Slip formwork)

Permanent Insulated Formwork Systems (ICF): Such formwork type is typically assembling at the site zone. When the solid is restoring, this formwork remains in one spot. It is a lot harder than different sorts of formworks and furthermore further enhance the nature of the fulfillment of development



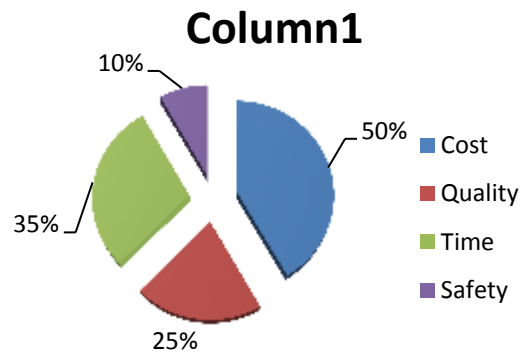
Source: Built Constructions In BANGALORE(Permanent Insulated Formwork Systems)

IV. DISCUSSION AND RESULTS

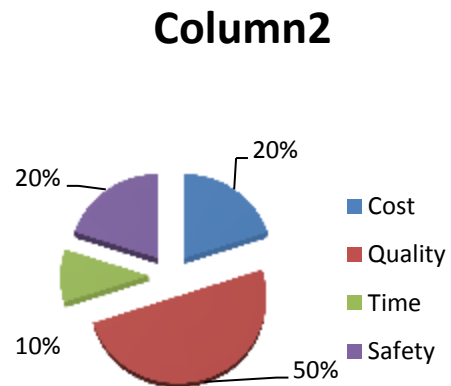
A. COMPARISON BETWEEN TRADITIONAL AND ADVANCEMENT FORMWORK SYSTEMS

The below pie charts showing the cost, quality, time and safety of the traditional formwork systems and advancement formwork systems in construction site.

Traditional formwork

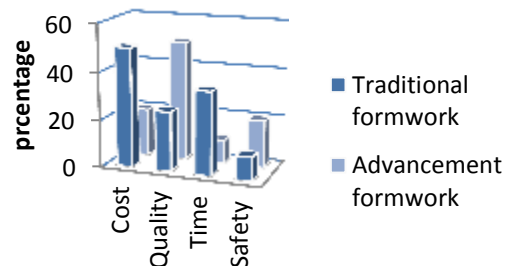


Advancement formwork



A. Comparison Between Traditional and Advancement Formwork Systems:

Chart Title



The above graph represents that by using these advancement formwork gives more efficiency in work than traditional formwork in construction site.

V. CONCLUSION

The above results (study) concluded that by this implementing advancement formwork will improve the quality of work in construction when compared to traditional formwork by nearly 25-30 %. The duration of the project gets reduced to 15-20% when applying this advancement formwork in the construction site. By using this advancement formwork cost gets reduced to nearly 20-25 %. The safety and efficiency of the work get improved to 10-15%. But implementing this advancement formwork in the construction site is far from satisfying due to lack of knowledge and due to lack of skilled labor.

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