

A REVIEW PAPER ON FEASIBILITY OF MIVAN FORMWORK TECHNOLOGY OVER CONVENTIONAL FORMWORK TECHNOLOGY FOR CONSTRUCTION PROJECTS.

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Abstract – Construction is one of the significant sectors of Indian economy and is an integral part of the development. Today India's urban population is the second largest in the world and its future development leads to increased demand for housing to cope with this problem India should desperately need to plan for acquisition of land and rapid creation of dwelling units. Construction is a complex process involving basically the areas of Architectural planning, Engineering & Construction. There is growing realization today that speed of construction needs to be given greater importance especially for large housing projects. This is not only essential for the faster turnover of equipment and investment leading possible to the reduction in the housing cost but also for achieving the national objective of creating a large stock to overcome shortest possible time. Fortunately, some of the advanced technologies catering to faster speed of construction are already available in the country. For e.g. Prefabrication, autoclaved blocks, tunnel formwork, aluminium formwork (MIVAN Technology) of construction etc. The aluminium formwork system was developed by Malaysian Company and that's why the aluminium formwork technology is named after it.

Key Words: Mivan Formwork system, Conventional Formwork system, Cost, Quality, Duration, Speed of construction etc.

1. INTRODUCTION.

Formwork is defined as temporary structure whose purpose is to provide support and containment for fresh concrete until it can support itself. It moulds the concrete to the desired shape and size and controls its position and alignment. The development of formworks is parallel with the growth of concrete construction throughout the 20th century. The advancement of technology, increase of population and the space limitation lead the way to construct high-rise buildings. But the task was not very easy at the beginning but now the man made the task easy by inventing new machinery and new techniques. 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. The first formwork type to be used is the conventional type formwork where the timber planks were supported on timber columns. With the advancement of technology it developed gradually and people used ply wood sheets instead of timber planks and steel pipes with jacks were used to support the ply wood. Then people invented small units of formworks and connect the repeating units in the construction. The larger units were invented like formworks for slab panels, formworks for columns, beams etc. when the same elements are repeating. Then finally the whole system of formwork is made and initially the material used to it was steel and it was very heavy. Then the aim was to reduce the weight of the system and the materials for formwork have extended to aluminium, plastic, fiber glass etc. 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 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. As described by the manufacturers a low-cost system for housing using aluminium formwork. Aluminium formwork system is construction system for forming cast in place concrete structure of building. It is also a system for scheduling and controlling the work of other construction trends such as steel reinforcement, concrete placement and mechanical and electrical conduits. 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. The speed of construction by this system will surpass speed of most of the other construction method.

2. LITERATURE REVIEW.

- 1. Arbaz Kazi1, Fauwaz Parkar (2015):** It can be concluded that on the basis of results obtained it can be concluded that for the study project, Plastic formwork seems to be the best feasible solution for the project. Although Doka, Peri, RMD etc. seems to consume less time but the overall cost is quite large and in India, where there are many uncertainties involved in a project, any stoppage of work due to whatever reason, leads to a huge impact on the pockets of developers; as Doka, Peri and RMD needs additional equipment along with its own infrastructure to

perform its functions. Also Plastic functions same as conventional timber and does not required any additional equipments for installing, if work is stopped due to certain reason the losses incorporated will not be huge as in case of other techniques. For this study, MIVAN formwork technique was not taken under consideration, as its initial cost is very high. Also recent studies have shown that MIVAN shuttering becomes economical only if it is used in Mass Housing Projects. The decision was made on parameters like cost, quality, speed of construction etc. but the aspects like safety, uncertainties, site restrictions and constraints must be studied in detail to have a complete picture of reality and hence arrive at a more precise and trustworthy decision.

2. **A. Sharmila, Aaron Christopher (2016):** in this literature factors affecting selection of formwork were identified through literature study & experts opinion. A questionnaire survey is conducted on high rise building construction projects (above G+5) to find out factors influencing formwork selection in construction projects. The study received 30 respondents the collected data was analyzed through both Relative Important Index method and Microsoft excel. According to their rank indexes the top 5 factors has been ranked accordingly for 30 completed surveys. The top 5 factors are quality and surface smooth, time factor, lifespan, cost and safety. Based on these factors comparative table was prepared from that decision support model was made. And this was analyzed on ongoing and completed projects it gives more than 90% accurate results. From this model the project managers can select the formwork easily based on their requirements.
3. **P.Dinesh, M.Soundararajan (2017):** This study focused on identifying the qualitative factors affecting the selection of the formwork at various constructions. Adaptability & Flexibility (Fixable Sizes) Formwork should be modular and adaptable for various sizes and shapes of the structural system, so that it can be used for many projects. Formwork should be viable for the particular project based on cost and availability, Quality & Surface Finish Quality, of structural finish ,Availability Material and supplier availability, Cost, Type of Structure , Time Factor Faster floor cycle is always affects the formwork selection are also adaptability, flexibility, quality cost, type of structure, time factors plays major role while selection of formwork.
4. **Prof. R. B. Bajare, Shubham Deshmukh, Ashwin Mahajan, Roohi Karnataki, Indrayani V. Patil. (2017):** The purpose of choosing Mivan Technology over conventional method was the speedy construction, Monolithic homes in landslide prone zone and Strengthened structure in high rainfall intensity area. Due to complexity of reinforcement and less thickness of wall, problems of honeycombing and shear cracks due to mass concreting are observed on sites and also, the problem was identified on other sites too. Therefore these problems need to be tackled in effective way to ensure quality and safety of structure. These problems can be reduced by improving concrete characteristics to meet the objectives; performed the compression test and slump cone/ flow table test on the concrete using admixture. On site only M25 grade was used as the structure was single story building. But we have tested the M35 and M45 also because the result will be beneficial to multi story building which use the M45 and M 35 commonly and in combinations. Thus this project concludes that the problem of honeycombing will be reduced and the strength is increased by used of admixture.
5. **Rahul B. Mojidra¹, Pinal H. Patel, Vinu R .Patel (2017):** Focused on the seismic design of buildings, reinforced concrete structural walls, or shear walls, act as major earthquake resisting members. Concrete walls are provided for the additional gravity force resistant. The properties of these seismic shear walls dominate the response of the buildings, and therefore, it is important to evaluate the seismic response of the walls appropriately. In these papers conventional, monolithic with external walls structural systems and monolithic with internal wall system for G+ 20, G+ 25, G+ 30 story's was studied with the help of ETABS v 15 analysis and design. Additional Parameters like Lateral displacement, story drift are calculated for both the structures. we concluded that there is drastic improvement in the monolithic structure as compared to conventional structure in term of strength as well as cost.
6. **Naveen V. Chikkaveerayanavar, Naresh Patil (2017):** Discussed on the rise of the population of the country, the task of construction process as monumentally increased. As we all know the construction of high rise building is becoming a trend and the process of construction of these high rise building takes more time and hence to reduce the duration and cost of the project advanced technology are adopted. The new advanced technologies are manufactured for the construction of multi stored project which leads to production of cost efficient and speedy construction on residential projects.
7. **Prof. Ashish P.Waghmare,(2017):** Proposed an generalized approach, at early days building were constructed using conventional type form work system where wooden planks, runners, poles were used for the form work. With the development of technology, a tend to used plywood in its place of planks, steel jacks for support instead of wooden

poles. Due to increase in inhabitants, people started to construct the dwelling building. At early days buildings were constructed using modern type form work system.

- 8. Miss. Jyoti Suresh Magdum, Prof. Madhav Bhalchandra Kumthekar, Prof. Gayatri Dhananjay Jadhav,(2017):** In the world of competition the contractor is trying to reduce the cost of the formwork to reduce the cost of the product. But the reduction in cost of the product may leads to the problem of unevenness, honeycombing, and lack of levels & lines. To avoid this new development is taken place in the form of Aluminum formwork. Several formwork systems are in use at different places in the world, eventually the systems which are reasonably economical and easy for operation with skilled labor are more useful in India. Leading players in this industry are Doka, Mascon System, MFE Formwork Technology (Mivan), Meva, Waco, Forming Access and Support, Inc. (FASI), Peri, BSL Scaffolding, Uday Structural's & Engineers, Paschal and Pranav Construction Systems. In the present construction the cost of formwork may differ 20% to 65%, in case of fears competition contractor is always trying to complete the project in time with better & acceptable quality without line & level. If at all you want to make tool to effective shuttering the line, level or quality of concrete is increased the costs for touchup will n times high, again that may become the problem for sustainability & durability of structure. Hence in incent time lots of advancement has taken place in case of formwork technology. The world is moving basically from Timber to Steel & now from Steel to Aluminum. For AF the advantage is lightweight & more the number of usages.
- 9. Vasav R. Rakholia¹, Srinil H. Soni (2017):** This paper means to look at benefits and faults by utilizing an ordinary timber formwork system and current formwork system like Mivan. The examinations incorporate costs, time, and nature of these frameworks. For better comprehension of this subject, diverse development destinations are contemplated where most propel methods in formwork are utilized and the information gathered from these locales is exhibited keeping in mind the end goal to give examination between present day Mivan formwork and conventional formwork framework Formwork, which holds and supports wet cement till such time it cures, is an exceptionally key component in concrete construction. The modern methods of construction such as 'Mivan formwork system' are the key to meeting the demand for efficient, sustainable housing. Also the quality and speed must be given due consideration with regards to economy.. This type of formwork often had poor safety features and gave slow rates of construction on-site and huge levels of waste – inefficient and unsustainable. Modern formwork systems, which are mostly modular, designed for speed and efficiency. They are engineered to provide increased accuracy and minimize waste in construction and most have enhanced health and safety features built-in. by using 3R system i.e. reduce, reduced, and recycle.
- 10. S. Bhargavi pujari, D. B. Bhosale, R. D Shinde. (2018):** Among the total cost of construction a major part is occupied by formwork. Therefore, the cost of construction can be reduced by proper planning of system of formwork to be used. Usage of Formwork technology has increased extensively in construction industry as it enables faster execution and better results. Indian construction industry has eventually adopted some of the world class formwork technologies which are reasonably economical and easy for operation using semi-skilled labor. These papers aims to save cost invested in construction and reduce the time required for construction by using Kumkang formwork system and show the benefits of the Kumkang formwork system on conventional formwork system. We thus infer that using Kumkang formwork system is cost effective and saves construction time proving better quality of construction.
- 11. V. Aditya, Dr. s. ananda Kumar,(2018):** For a country like India where population and inflation have faded, poor people dream of owning a home will be made true only by government sponsored affordable schemes. Pradhan Mantri Awas Yojana (Gramin) is one such scheme launched by P.M Narendra modi in 2015 to provide shelters to the homeless by 2022 (i.e.) within 7 years which is a time constrain. This technology can be made useful for the PMAY scheme. In this scheme technology used for construction of affordable houses gives quality and speed achieved at high degree, which is the need of the day. The cost of construction done by the aluminum formwork technology is 18.4% lesser than the conventional method. There will be no need to borrow money through loan or from lenders for excess cost as in the case of conventional method. Over all government sending for these projects can be saved up to average 20% cost. This cost can be used for implementing renewable energy like solar power for the same house itself. Duration of construction by aluminum formwork technology is less than conventional .In seismic zones this technology will be best suitable than conventional and also prefabricated structures because of use of shear reinforcement for wall also. This method is best suitable for a row houses scheme which gives cost effectiveness over the construction.
- 12. Pathan H. Majeed, Akash Padole, Amir Ali Plasterwala (2019):** Explained that in high rise building construction, the most efficient way to speed up the work is by achieving a very short floor cycle. That directly depends on the selection of formwork for the construction. The formwork development is equally important to the development of concrete in the construction industry. Nowadays extra effort has been put to improve the design of shuttering which

ultimately leads to the reduction in weight. Apart from the primary materials of conventional techniques, the materials are now extended to aluminum, plastic, fiber glass, etc. Significant use of advanced formwork is suitable for complex construction processes and provides best results in cost effectiveness. Thus from the above points it is quite clear that construction by aluminum and doka formwork is quite expensive than the Conventional Method. However, it can save considerable amount of time in construction of high-rise building. Also, many of the finishing works is saved in aluminum and doka which includes plastering (both internal and external), brickwork.

13. Bhagirathi Singh, Dr. Pankaj Sing (2019): Covered every aspect related to conventional and aluminum form of construction. Thus, they infer that aluminum form construction with Conventional formwork, Tunnel formwork, Climbing formwork, mivan formwork, Slip formwork Tunnel formwork stands to these expectations as it allows a slab cycle within 1 to 3 days and high quality which reduces finishing works. This reduces cost by 40% and time by 60% when compared to conventional formwork.

14. Vijay anil Sonawane, Harshita Ambre (2019): India is the developing country where rapid development in infrastructure sector is more important. For that purpose using advance construction technique over the old or traditional construction techniques is important. For that purpose use of aluminum formwork by replacing conventional formwork system in the construction of mass housing projects like multi story buildings, row houses projects etc. Formwork system plays a very important role in successful and timely completion of construction project. From the comparative analysis it's clear that, Aluminum formwork is not only Cost effective but also time saving technology in comparison with Conventional Formwork. Aluminium formwork is better for use in the constructions, where Time saving formwork is necessary, than Conventional Formwork (especially mass housing projects). It can be useful in the developing country like India where repetitive type of mass housing projects is constructed.

3. CONCLUSION

Based on literature survey and referred journals, it can be concluded that the modern techniques of construction such as mivan technology is the way to meet the requirement of affordable and efficient housing. Mivan technology system is able to provide higher quality construction with respect to economical condition at unpredicted speed of construction. This formwork system has a great potential to present Indian scenario to provide affordable housing on its increasing population. The Conventional formwork can be used for 8 to 9 times whereas Mivan formwork can be used more than 250 to 300 times as compared to conventional formwork. Mivan formwork overcomes the issues of repairs and modification due to improper workmanship. Mivan formwork can be said the most appropriate system for high rise and massive construction projects. Thus it can be summarized that mivan formwork system can be economical for projects of repetitive and massive in nature or else conventional formwork system would be economical.

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