



A Review Paper on Comparative analysis of MIVAN Formwork Technology and Conventional Formwork Technology

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ABSTRACT

Structure is a vital part of the Indian financial system and among the most important sectors. It is also a crucial component in the nation's progress. India is frantically trying to plan for mass production and the creation of housing units for cost-effective construction. Formwork allows for the casting and building of critical parts and components of any construction facility which must be powerful and able of handling the structure. MIVAN is a relatively new technology system on the horizon for the satisfactory implementation of mass projects, particularly those that are easily predictable. In this paper, we make comparisons MIVAN advanced technologies to traditional prefabrication innovation in terms of both cost and time. In comparison to traditional technology, MIVAN technology is significantly more efficient in terms of price, reliability, and duration. The main goal is to come to a firm conclusion about which of the two methodologies is better compared from the other. The Economic viability of MIVAN Prefabrication Innovation over Traditional Prefabrication Innovation for Construction Industry is described in this paper.

Keywords: Formwork, MIVAN, Technology, Conventional

1. INTRODUCTION

The MIVAN Innovation Method was designed by a Malaysian company as a cost-effective framework for mass housing management in developing countries. The system ensures a quick and cost-effective method of construction by allowing structural members to be erected multiple times in a monotonous design. The aluminum aspects induce significant concrete surface quality that enables for an excellent quality feature wall without any need for external or internal plastering. This system has been identified as being particularly well suited to Indian circumstances for large scale concrete construction, in

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which excellent performance and quickness could be accomplished at a minimal price. This system's construction speed will be faster than most other recent construction techniques and materials.

MIVAN is an advanced aluminium hegemonic pouring formwork. In this system, walls, columns, slabs, and beams are all poured together. In comparison to other developed and competitive countries around the world, India's construction industry uses MIVAN formwork very infrequently. The construction industry has the greatest potential for MIVAN formwork technology. This formwork is a sophisticated construction material that is also cost-effective in heavy-duty projects. By using efficient construction tools, construction materials, and time for construction saving, this recent method of construction by this technology can significantly increase construction productivity, built quality, and durability of construction work when compared to conventional technologies or methods. This technology is one of the most recent construction technologies to emerge at a rapid pace in the Indian construction industry, particularly for the successful completion of various construction projects, particularly mass housing projects. This study is critical because it can provide critical information on the total cost of construction and total duration of construction in the Indian construction industry, where both economy and time are critical factors.

2. FORMWORK

Formwork is a short term process that enables concrete to be molded into the shape desired while remaining in the proper position until hardened. It also bears the weight that has been placed on it. False work is a framed structure of infilled frames that retains the formwork in place. Once formwork is left in place, it produces effective healing methods. Stripping refers to the process of removing formwork. The stripped formwork can be reused. Failure of the form work during construction loss as a result of money and time, as well as injuries and death. Formwork could be made of a variety of materials, including wood, plywood, aluminum, and precast concrete. Steel and aluminum have had a benefit over other materials in that they can be reused. Timber has the disadvantage of shrinking, swelling, and shrinking.

2.1 REQUIREMENT OF GOOD FORMWORK

- a. It should be able to withstand a variety of loads.
- b. It should be well-built and well-supported.
- c. Construction lines must be accurate.
- d. It should be simple to remove.

- e. It must not become warped.
- f. It ought to be easily accessible and re-usable.

2.2 CONVENTIONAL FORMWORK

This formwork is made up of conventional framed panels that are connected by horizontal members known as wailing. The longitudinal power of wet concrete is resisted by the wailing. The formwork is first constructed and properly aligned, plumbed, and strutted on one side. After the side formwork has been placed, the other end formwork is erected. All of the building elements are constructed using this formwork system.

Advantages of Conventional Formwork:

- Along with its light weight, it is simple to handle.
- It's simple to take out.
- Parts that have been damaged could be replaced immediately.
- It is extremely adaptable.
- Easily accessible.

2.3 MIVAN FORMWORK

• **Requirement of MIVAN Formwork**

The Mivan formwork is made of an aluminium alloy. The formwork should carry, in addition to its own mass, the swelling of the wet cement, the imposed loads owing to collaborate, and the impact on it by pouring concretes and labourers while construction is underway. Vibrations caused by vibrators which are used to decrease the solid should be considered.

As a result, a major element of the structure's growth is the formwork design, which takes into account its requirements. The Mivan Formwork ought to be able to withstand a live load of around 370 kg / m², according to the manufacturer's specifications. It's that the prefabrication configuration, whatever it is, isn't too difficult to work with a little well-being calculation. After deflection due to weight of concrete and fortification, the prefabrication surfaces should wear to the point where the surface continues to remain level or as desired by the architect. Sheathing with such a full live weight of 370 kg / m² and underlayment with a live load of 200 kg / m² really shouldn't be redirected more than 0.25 cm. The data's integrity must be preserved. MIVAN formwork is designed in such a way that it can be easily changed and evacuated, allowing production to begin quickly and with little variation in dimensional resistance. It must also be completely adaptable, with the ability to change the format easily for any variety

- **Advantages of MIVAN:**

- Consistent dimensioning is ensured by high-quality formwork.
- After the mould is removed, a high-quality concrete finish with precise tolerances and verticality is produced.
- The entire concrete structure is formed by the total system.
- Designed specifically for the project.

- **Advantages of MIVAN formwork over conventional construction.**

- A higher level of seismic resistance is achieved.
- A complete concrete structure has greater durability than traditional brick bat masonry.
- Shear walls make the walls thinner, allowing for more carpet area.
- Due to the light weight of the forms, unrivalled construction speed can be achieved.

2.4 Comparison of MIVAN /ALUMINIUM Form Construction Technique over Conventional Forms

Table 1 : Comparison of MIVAN Form Construction Technique over Conventional Forms

Sr. No	FACTOR	CONVENTIONAL	MIVAN	REMARKS
1	Quality	Normal	Superior. In – Situ casting of whole structure and transverse walls done in a continuous operation, using controlled concrete mixers obtained from central batching, mixing plants and mechanically placed through concrete buckets using crane and compacted in leak proof moulds using high frequency vibrators	Superior quality in “System housing”
2	Speed of construction.	The pace of construction is slow due to step – by – step completion of different stages of activity the masonry is required to be laid brick by brick. Erection of formwork, concreting and ddeshuttering forms is a two – week cycle. The plastering and other finishing activities can commence only thereafter.	In this system, the walls and floors are cast together in one continuous operation in matter of few hours and in built accelerated curing overnight enable removal and re-use of forms on daily cycle basis.	System construction is much faster.
3	Aesthetics.	In the case of RCC structural framework of column and beams with partition brick walls is used for construction, the columns and beams show unsightly projections in room interiors.	The Room – Sized wall panels and the ceiling elements cast against steel plates have smooth finishing and the interiors have neat and clean lines without unsightly projections in various corners. The walls and ceilings also have smooth even surfaces, which only need colour/white wash	

4	External finishes.	Cement plastered brickwork, painted with cement – based paint. Finishing needs painting every in three years.	Textured / pattern coloured concrete facia can be provided. This will need no frequent repainting.	Permanent facia finishes feasible with minor extra initial cost
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Sr. No	FACTOR	CONVENTIONAL	MIVAN	REMARKS
5	Useful carpet area as % of plinth area.	Efficiency around 83.5%	Efficiency around 87.5%	More efficient utilization of Land for useful living space.
6	Consumption of basic raw materials Cement. Reinforcing Steel	Normal Reinforcing steel required is less as compared to the in situ construction as RCC framework uses brick wall as alternative	Consumption somewhat more than that used in conventional structures. It may, however will be slightly more than corresponding load – bearing brick wall construction for which, requirements of IS 456 have to be followed for system housing.	Although greater consumption strength and Durability is also more Steel requirements more, as it is required for the shear wall construction. But shear wall construction increases safety against earthquake.
7	Maintenance	In maintenance cost, the major expenditure is involved due to : <ul style="list-style-type: none"> Repairs and maintenance of plaster of walls / ceiling etc. Painting of outer and inner walls. Leakages due to plumbing and sanitation installation.	The walls and ceiling being smooth and high quality concrete repairs for plastering and leakage's are not at all required frequently.	It can be concluded that maintenance cost is negligible .

Table 2 : Effect of construction speed on the cost of flat

Description	Construction Speed			
	A	B	C	D
Construction speed	3 flats/day	4 flats/day	5 flats/day	6 flats/day
Period of const.	23 months	18.7 months	16.2 months	14.2 months
Forming area	741.9	989.2	1236.5	1483.8
Misc formwork	55.5	55.5	55.5	55.5
Total formwork to be ordered	797.4	1044.7	1292	1539
Cost of formwork	14353200	18804600	23256000	27707400
Two third of the loaded cost	9568800	12536400	1550400	18471600

Profit & Overhead 15%	1435320	1880460	2325600	2770740
Total Rs.	11004120	14416860	17829600	21242340
Cost per flat, Rs	9825	12872	15919	18966

Courtesy: JogeswariVikhroli link road, NNP Nivara Parishad,MMRDA)

3. Literature Review

1. Arbaz Kazi, Fauwaz Parkar (2015) provide us the Based on the findings, this can be indicated so for the research study, plastic formwork appears to be the most feasible solution. Although Doka, Peri, RMD, and others appear to take less time, the total cost is quite high, and in India, where projects are fraught with uncertainties, any halt in work, for whatever reason, has a significant impact on developers' pockets; as Doka, Peri, and RMD require additional equipment as well as their own infrastructural facilities to perform their functions. Also, because plastic functions similarly to traditional wood and does not require any additional equipment for installation, if work is halted for any reason, the losses incurred will not be as significant as with other techniques. The MIVAN prefabrication technique was not considered for this study because of its high initial cost. Recent research have also shown that MIVAN shuttering is only cost effective if used in housing projects. The decision was based on factors such as cost, quality, and construction speed, but other factors such as safety, uncertainties, site restrictions, and constraints must be thoroughly investigated in order to obtain a complete picture of reality and thus make a more precise and reliable decision.
2. A. Sharmila, Aaron Christopher (2016): Throughout this study, the factors that influence formwork selection were identified through a literature review and expert opinion. To learn more about the factors that influence formwork selection in building projects, a questionnaire survey was conducted on high-rise building projects (above G+5). The survey had 30 participants, and the data was analyzed using the Relative Importance Index and Microsoft Excel. For 30 completed surveys, the top 5 factors were ranked as according their rank indexes. Quality and smoothness of the surface, time factor, lifespan, cost, and safety are the top five factors. A comparative table was created based on these factors, and a decision - making support model was created. And when this was tested on continuing and completed projects, it yielded results that were more than 90% accurate results. From this model the project managers can select the formwork easily based on their requirements.
3. M.Soundararajan and P.Dinesh (2017): The goal of this study was to identify the qualitative factors that influence formwork selection in various constructions. Adaptability and flexibility are two words that come to mind when thinking about adaptability and flexibility (Fixable Sizes) Formwork should be customizable and adaptable to a variety of structural sizes and shapes so it can be used on a variety of projects. Formwork should be suitable for the project in terms of cost and availability, as well as quality and surface finish, structural finish, and availability. Availability of materials and suppliers, cost, structure type, and time factor faster floor cycles have an impact on formwork selection, as do adaptability, flexibility, quality, cost, and structure type. Time factors also play a significant role in formwork shortlisting.
4. Prof. R. B. Bajare, Shubham Deshmukh, Ashwin Mahajan, Roohi Karnataki, and Indrayani V. Patil. (2017) provided in there paper that the The advantages of Mivan Technology over traditional methods included faster construction, homogeneous homes in landslide-prone areas, and strengthened structures in areas with high rainfall intensity. Caused by construction and shear fractures due to the mass concreting have been observed on sites, and the problem has also been recognized on other sites due to the complexity of the reinforcement and the thinner wall thickness. As a result, these issues must be effectively addressed in order to ensure the structure's quality and safety. These issues can be alleviated by enhancing concrete properties to accomplish the expectation; using

admixture, compression and slump cone/flow table tests were performed on the concrete. On site only M25 grade was used as the structure was single story building. Because the structure was a single story building, only M25 standard was used on site. However, we evaluated the M35 and M45 because the results will benefit multi-story buildings that frequently are using the M45 and M 35 in combination. As a result of the use of admixture, the problem of micro cracks will be reduced, and the strength will be increased.

5. Pinal H. Patel, Vinu R. Patel (2017): 5. Rahul B. Mojidra1, Pinal H. Patel, Vinu R. Patel (2017): Reinforced cement concrete walls, also known as shear walls, are major earthquake resisting members that are concentrated on the seismic design of buildings. Additional gravity force resistance is provided by concrete walls. Because the seismic response of the seismic shear walls dominates the response of the buildings, it is critical to assess the seismic behavior of the walls appropriately. With both the assistance of ETABS v 15 analysis and design, traditional, homogeneous with outer walls structural systems, and homogeneous with internal walls structural systems for G+ 20, G+ 25, and G+ 30 stories were studied. Both structures have additional parameters calculated, such as lateral displacement and story drift. In terms of both strength and cost, we concluded that the monolithic structure outperforms the conventional structure.
6. Naveen V. Chikkaveerayanavar and Naresh Patil: As the country's population grows, the assignment of construction has become monumentally more difficult. As we all know, high-rise building construction is becoming more popular, and because the process of constructing these high-rise buildings takes longer, advanced technology is being used to shorten the project's duration and cost. For the building projects of multi-storey projects, highly innovative technologies are being developed, resulting in cost-effective and quick building projects 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. Prof. Madhav Bhalchandra Kumthekar, Prof. Gayatri Dhananjay Jadhav, Miss. Jyoti Suresh Magdum, (2017)In today's competitive world, the contractor is attempting to lower the cost of the formwork in order to lower the cost of the finished product. However, the product's lower cost may result in unevenness, honeycombing, and a lack of levels and lines. Aluminum formwork has been developed to avoid this new development. Several formwork systems are in use around the world, but in India, the systems that are reasonably cost-effective and simple to operate with skilled labour are more useful. 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 are among the industry's top players. In today's construction, the cost of formwork can range from 20% to 65%, and in the event of competition, the contractor will always try to complete the project on time, with better and acceptable quality, without using line and level. If the level or quality of concrete is increased to make a tool to effectively shutter the line, the costs for touchup will increase n times as well, posing a problem for the structure's sustainability and durability. As a result, there has been a lot of progress in formwork technology in recent years.
9. Srinil H. Soni, Vasav R. Rakholia, Vasav R. Rakholia, Vasav R. Rakholia, Vasav R. Rakholia, and Vas (2017), this paper aims to compare the advantages and disadvantages of a traditional timber formwork system and a modern formwork system such as Mivan. The costs, time, and nature of these frameworks are all examined. Various development destinations are considered for a better understanding of this subject, where most propel methods in formwork are used, and the information gathered from these locales is displayed with the end goal of giving examination between modern Mivan formwork and traditional formwork framework. Formwork is an extremely important component in concrete construction because it holds and supports wet cement until it cures. Modern

construction methods, such as the 'Mivan formwork system,' are critical to meeting the demand for efficient, high-quality construction, Sustainable housing. Housing that is environmentally friendly. In terms of economy, quality and speed must also be taken into consideration. This type of formwork was frequently lacking in safety features, resulting in slow construction rates on-site and massive waste – inefficient and unsustainable. Modern formwork systems are designed for speed and efficiency, and are mostly modular. They are designed to increase accuracy and reduce waste in construction, and most have built-in health and safety features. They use the 3R system, which stands for reduce, reduce, and recycle.

10. S. Bhargavi Pujari, D. B. Bhosale, and R. D. Shinde(2018) Formwork accounts for a significant portion of the total construction cost. As a result, proper planning of the formwork system to be used can reduce construction costs. Formwork technology is increasingly being used in the construction industry because it allows for fast processing and better results. The Indian construction sector has finally adopted some world-class formwork technologies that are both cost-effective and simple to operate with semi-skilled labour. The purpose of these papers is to promote the effectiveness of the Kumkang form work over the conventional formwork system in terms of lowering construction costs and shortening construction time. As a result, we can deduce that the use of Kumkang formwork is beneficial.
11. V. Aditya and Dr. S. Ananda Kumar, 2018: Poor people's dreams of owning a home will only be realized through government-sponsored affordable housing schemes in a country like India, in which population and inflation have faded. P.M. Narendra Modi launched the Pradhan Mantri Awas Yojana (Gramin) in 2015 with the goal of providing shelter to the homeless by 2022 (i.e., within 7 years), which is a deadline. The PMAY scheme could benefit from this technology. In this scheme, the technology used to build affordable houses achieves a high level of quality and speed, which is a requirement of the day. The aluminum formwork technology reduces the cost of construction by 18.4 percent compared to the traditional method.As opposed to the traditional method, there should be no need to borrow the money through a loan or from lenders at a high cost. Government spending for these initiatives can be reduced by up to 20% on average. This money could be put toward renewable energy, such as solar power, for the same house. Construction using aluminums formwork technology takes less time than traditional methods. Because of the use of transverse reinforcement for the walls, this innovation will be more suitable in seismic zones than conventional and prefabricated structures. This method is most suitable for just a row house scheme that provides cost efficiency in construction.
12. Pathan H. Majeed, Akash Padole, and Amir Ali Plasterwala (2019): Pathan H. Majeed, Akash Padole, and Amir Ali Plasterwala Explained that the most effective way to improve work in high-rise building construction is to achieve a very short floor cycle. This is directly dependent on the type of formwork used in the construction. In the construction industry, formwork development is just as important as concrete development. Nowadays, more effort is being put into improving the design of shuttering, which results in a weight reduction. Aside from the raw material used in traditional techniques, aluminums, plastic, and fiber glass are now used. The extensive use of sophisticated formwork is appropriate for complex building process and providing the most cost-effective results.As a result of the foregoing, it is clear that aluminums and duke formwork construction is more expensive than conventional method. It can, however, save a significant amount of time in the construction of high-rise buildings. Many of the trying to finish works, such as plastering (both internally and externally), and brickwork, are also saved in aluminums and dike.
13. Dr. Pankaj Singh, Bhagirathi Singh (2019): Every aspect of traditional and aluminums construction was discussed. As a result, they conclude that aluminums formwork with Traditional formwork, Tunnel frame, Climbing scaffoldings, MIVAN formwork, and Slip formwork is the best option. Tunnel formwork meets these requirements because it allows for a slab cycle time of 2 - 3 days and good quality, reducing finishing work. When compared to traditional formwork, this saves 40% of the cost and 60% of the time.
14. Harshita Ambre, Vijay anil Sonawane (2019): India is a developing country with a high priority on rapid infrastructure development. It is critical to use advanced construction techniques rather than old or conventional construction techniques for this purpose. For this reason, aluminums formwork is being used instead of traditional

formwork in the construction of mass housing projects such as multi-story buildings and row house projects. The formwork system is critical to the timely and successful completion of a construction project. In comparison to conventional formwork, the comparative analysis shows that aluminum formwork is nonetheless cost effective but it also time saving. Metal formwork is better for use in constructions where time saving formwork is required (especially mass housing projects) than conventional formwork. It could be useful in developing countries like India, where mass housing projects are built in a predictable pattern.

4. CONCLUSION

This same task of housing has become progressively monumental as the country's population grows. The potential for technological abilities to meet this challenge is immense; it only requires to be wisely exploited. Structural engineers not only construct structures, but also improve people's quality of life. Their ingenuity and technical expertise aid in the planning, design, construction, and operation of life's necessities. Civil engineers must learn how to acquire and use powerful and flexible construction tools. Construction companies around the world have historically been slow to embrace innovation and change. Contractors are a cautious bunch. It takes time to analyse the problem in depth and come up with effective solutions. MIVAN is a cost-effective and efficient tool for resolving problems associated with mega housing projects around the world. On the whole, MIVAN wants to make the most of modern building techniques and equipment. We've attempted to cover every aspect of the aluminum (MIVAN) form construction process. As a result, we can conclude that MIVAN form building can deliver high-quality construction at a reasonable cost. This technology has a lot of potential in India for providing affordable housing to the country's growing population.

Based on a review of the literature and references, this can be concluded that modern construction techniques, such as mivan technology, are the best way to meet the demand for efficient and cost-effective housing. The Mivan technology system is capable of providing higher-quality construction at unanticipated construction speeds while also being cost-effective. This formwork system has a lot of potential in the current Indian situation in terms of providing affordable housing for the country's growing population. Conventional formwork can be reused 8 to 9 times, whereas Mivan casing can be reused more than 250 to 300 times. Mivan formwork eliminates the need for repairs and modifications caused by shoddy workmanship. The Mivan formwork system is the most suitable for high-rise and large-scale construction projects. To summarize, the mivan formwork system is cost-effective for projects that are monotonous and massive in nature, whereas the conventional formwork system is not.

Thus it can be concluded that quality and speed must be given due consideration with regards to economy. Good quality construction will never deter to projects speed nor will it be uneconomical. In fact time consuming repairs and modification due to poor quality work generally delay the job and cause additional financial impact on the project. Some experts feel that housing alternatives with low maintenance requirements may be preferred even if at the slightly higher initial cost.

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