Comparative Study Between Regular Framed Structure and Mivan Structure

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***Abstract*—One of the major industries driving India's growth is construction. With the country having the second-largest urban population in the world, the need for housing is increasing quickly. To meet this demand, India needs to plan well for land purchases and fast construction of homes. In any construction project, formwork (the molds used to shape concrete) plays a big role making up about 35 to 40% of the total cost. It also affects how fast, safe, and good-quality the construction is. Both the client and the contractor want the project finished quickly the client so they can start using the building, and the contractor to earn more profit. One of the best ways to speed up housing projects is to reduce the time it takes to complete each floor. The type of formwork used plays a big role in how long the project takes.**

This study focuses on using aluminum formwork (specifically MIVAN technology), often used in tall buildings, by physically modelling a G+1 (Ground plus one floor) building. We've compared how MIVAN and regular (conventional) construction methods affect things like project time, cost, work quality, and whether MIVAN is suitable. We also made a cost estimate for both methods and created the building's floor plan using AutoCAD. A market survey was also done to better understand the costs involved in making the physical model.

***Index Terms*—Mivan structure, Aluminum formwork, Conventional Formwork**

I. INTRODUCTION

Along with food and clothing, shelter is one of the most basic needs for people. While India has managed to provide food and clothing for its large population, it still struggles to provide proper housing for everyone. According to a government plan, there is a shortage of 19.4 million housing unit about 12.76 million in rural areas and 6.64 million in cities. The housing problem is worse in urban areas, especially in 35 big cities that had over one million people, according to the 2001 census. It's even more serious in huge cities like Mumbai, Delhi, and Kolkata, where the population is over 10 million.

There are many reasons for this shortage. These include rapid population growth (mostly due to people moving from villages to cities), not enough available land, legal issues from rules like the Land Ceiling and Rent Control Acts, lack of funds, and not having affordable building methods. Although there have been a few efforts to fix these problems, there haven't been many strong or effective actions taken to solve them completely. Because of rapid growth in cities, slums and illegal settlements are spreading quickly. In July 1998, the National Housing and Habitat Policy was introduced. It focused on creating a good environment for private companies to build houses on a large scale, while the government's role would be to support and guide this process. In recent years, the government has introduced tax benefits and other financial reforms that helped the housing sector grow. As a result, many houses have been built in cities and small towns, especially for middle- and high-income families, due to low interest rates and easy access to loans. However, poor people have not gained much from this housing growth. In a democratic country like India, it is important to ensure that low-income families also get proper housing, but finding the right way to do this remains a challenge. Some efforts in Mumbai, such as the Metropolitan Urban Transport Project (MUTP), the Metropolitan Urban Infrastructure Project (MUIP), and the Slum Rehabilitation Authority (SRA), show possible solutions. Reports say that over 20,000 families have already moved into new homes under these programs,

and around 50,000 more homes are being built. This essay also explains MIVAN technology, a type of aluminum formwork system made by the MIVAN company. The main advantages of this formwork are low cost, good quality, fast construction, and better resistance to earthquakes. This study gives a detailed explanation of all these features.

II. LITERATURE REVIEW

P. M. Pol and A. P. Bhole (2017) carried out a comparative investigation between Mivan shuttering and conventional shuttering methods. Their study emphasized the enhanced speed and uniformity offered by the Mivan system, particularly in repetitive housing layouts. They concluded that although the initial expenditure is higher in Mivan, the time-saving benefits and reduced labour dependency justify its use in large-scale projects.

M. A. Khan and S. H. Naqvi (2019) presented a detailed comparison of aluminium formwork (Mivan) with conventional formwork. Their research highlighted Mivan's superior performance in terms of precision, surface finish, and overall construction efficiency. The authors also noted a significant reduction in plastering and finishing work due to the smooth concrete surfaces achieved with Mivan technology.

D. R. Sutar and A. S. Joshi (2020) analyzed the effectiveness of Mivan technology specifically in high-rise constructions. They found that Mivan formwork not only accelerated the construction process but also enhanced structural strength and uniformity. Their findings support the implementation of Mivan systems in urban multi-storey residential buildings, where repetitive design elements are prevalent.

The Indian Standard IS 14687:1999 provides essential guidelines for the design, use, and safety considerations of falsework in concrete construction. This document forms a critical foundation for understanding formwork performance, stability, and compliance in both Mivan and conventional systems.

According to the technical brochure provided by Mivan Company Ltd. (2022), the aluminium formwork system is engineered for durability, high reusability, and precision. The brochure outlines technical specifications and advantages, including faster cycle times, reduced finishing work, and long-term cost savings when deployed over multiple projects

III. FORMWORK

Formwork is a method used to shape concrete and hold it in place until it becomes hard. It also supports the weight of the concrete and any other loads during construction. When the formwork is supported by a frame to hold it steady, it is called falsework. If the formwork is left in place for some time, it helps the concrete cure properly. Removing the formwork after the concrete has set is called stripping. The removed formwork can often be used again. If the formwork fails during construction, it can lead to delays, extra costs, injuries, or even deaths. Formwork can be made from different materials like wood, plywood, aluminum, and precast concrete. Among these, steel and aluminum are stronger and more durable than other materials.

1.1 ESSENTIALS OF GOOD FORMWORK

- It must be strong enough to support all types of loads.
- It should be properly designed, constructed, and supported.
- The formwork should follow accurate construction lines and dimensions.
- It should be easy to remove without damaging the concrete.
- It must resist warping, twisting, or deformation.
- It should be reusable, economical, and readily available

1.2 CONVENTIONAL FORMWORK

In conventional formwork, wooden or metal panels are joined together with horizontal supports called *wailings*, which help resist the pressure of wet concrete from the sides. First, one side of the formwork is set up properly by making sure it is straight and stable. Then, the other side is added after the first part is in place. This type of formwork is commonly used in building all parts of a structure.

Benefits of Conventional Formwork:

- It is light in weight and simple to use.
- Easy to remove after the concrete sets.

- Damaged parts can be replaced quickly.
- It can be used for different shapes and designs.
- Materials are easily available in most places.

1.3. MIVAN FORMWORK

MIVAN formwork is made from an aluminum alloy, which is both strong and lightweight. It needs to hold not just its own weight, but also the pressure from wet concrete, workers, and equipment during construction. It also has to handle the vibrations from machines used to compact the concrete. That's why the formwork must be carefully designed to meet all these needs it plays a big role in building a strong structure.

According to the manufacturer, MIVAN formwork should be able to handle a live load of about 370 kg per square meter. The design also makes sure that the panels don't bend too much under pressure. The surface should stay smooth and flat, just like the architect wants, even after the concrete is poured and hardened. It's recommended that the bending should not go beyond 0.25 cm to maintain quality. Since MIVAN formwork can be reused and removed easily, it helps speed up construction with good accuracy. It can also be adjusted easily to suit different design needs

Advantages of MIVAN Formwork:

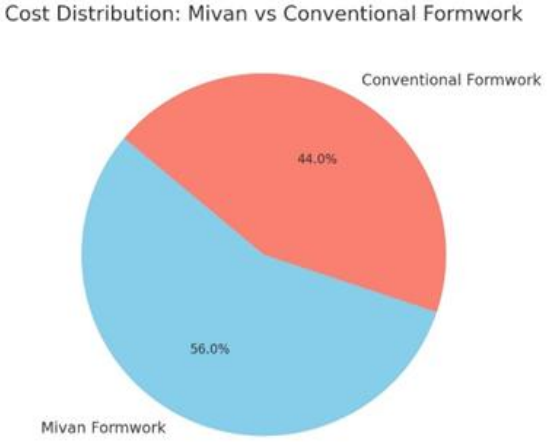
- High-quality formwork ensures all parts are the correct size.
- Smooth and accurate concrete finish after removing the mould.
- The entire structure is made from concrete using the same system.
- It is custom-made for each project.

Advantages of MIVAN over Conventional Construction:

- Better earthquake resistance.
- Full concrete structure lasts longer than brickwork.
- Thin shear walls allow for more usable floor space.
- Lightweight forms make construction much faster.

IV. RESULTS AND DISCUSSION

- As per calculation total cost of building of area 1350sqft. By using mivan shuttering is 2271433/- means 1682/- per sqft.
- As per calculation total cost of building by using conventional formwork is 1786384\- Means 1323/- per sqft.
- As per study when mivan formwork is used it gives 7 to 10 days cycle per floor but for conventional shuttering 21 days cycle per floor is required.
- As case study mivan structure gives greater finishing quality as compare to conventional shuttering.
- **Although the initial cost of mivan formwork is higher, it benefits in terms of speed, finish quality, structure monolithicity, and long term maintenance outweigh.**
- **The marginal cost difference making it preferred choice for repetitive and multi-unit housing developments like row houses and high rise buildings or 2 or more buildings having same structure.**



V. CONCLUSION

A comparative analysis between traditional formwork and Mivan (aluminium) formwork highlights the clear advantages of Mivan technology, particularly in terms of construction speed, surface quality, and long-term cost benefits. Although the upfront cost of Mivan formwork is relatively high, its ability to be reused multiple times makes it a cost-effective solution for

large-scale developments. The system's high precision and smooth surface finish often eliminate the need for plastering, leading to further savings in time and material. In contrast, conventional formwork is more suitable for smaller or uniquely designed buildings where flexibility in construction is a key requirement. In conclusion, Mivan formwork stands out as an ideal choice for mass housing projects aiming for efficiency, consistency, and superior build quality.

It is imperative for civil engineers to acquire and apply strong, adaptable construction tools. Historically, innovation and change have not been readily embraced by construction enterprises worldwide. The contractors are a wary group. Careful analysis and time are required to understand the problem and come up with effective solutions. MIVAN formwork presents a cost-effective and efficient approach to tackling challenges in mass housing projects globally. Its primary goal is to incorporate modern construction techniques and equipment to improve overall project execution.

Although the Mivan system has an upfront cost higher, it enables:

- Faster construction by 3–4 months
- Savings in internal plaster and finishing
- Less maintenance over time
- Better construction quality & resale value

This makes Mivan more economical in the long run, especially for repetitive housing projects like row houses.

VI. FUTURE SCOPE

With the increasing demand for rapid urbanization and affordable housing, the use of Mivan formwork is expected to grow in India and other developing countries. Future research can focus on optimizing the use of Mivan in high-rise buildings, hybrid systems combining Mivan and conventional methods for irregular layouts, and environmental impact analysis of aluminium formwork. Additionally, integrating Building Information Modelling (BIM) with Mivan construction can further enhance planning, execution, and cost control. Training programs and skill development in Mivan technology will also play a crucial role in its wider adoption in the construction industry.

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