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Mivan Formwork: A Modern Solution for Affordable Mass Housing

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Abstract - *Mivan formwork is an advanced aluminum formwork system widely used in modern construction for its efficiency, durability, and cost-effectiveness. Developed by Mivan Company Ltd., this system enables rapid and high-quality construction of reinforced concrete structures, making it ideal for mass housing and high-rise buildings. Unlike traditional formwork, Mivan offers modular, reusable components that facilitate faster cycle times and reduce labor dependency. Its lightweight nature, superior finish, and minimal requirement for post-construction plastering enhance overall project quality and sustainability. This paper explores the design, advantages, limitations, and applications of Mivan formwork in contemporary construction practices, emphasizing its role in accelerating project timelines and improving structural integrity.*

1.INTRODUCTION

1.1 *General*

Mivan technology is a modern aluminum formwork system developed by Mivan Company Ltd of Malaysia in the 1990s. It has gained widespread popularity as an efficient construction method, particularly for rapidly building large-scale housing projects. This system utilizes large, room-sized aluminum forms to cast walls and slabs in a single pour, resulting in a seamless monolithic concrete structure. Known for its speed, efficiency, and cost-effectiveness, Mivan formwork has been widely adopted in Mumbai, India, where numerous buildings showcase its suitability for local construction demands. Additionally, this technology is extensively used across Europe, the Gulf region, Asia, and beyond.A key benefit of Mivan formwork is its ability to allow early removal of molds, facilitated by hot air curing or specialized curing compounds**.** This enables rapid construction—potentially completing up to two apartments per day. The process follows an organized assembly-line approach, ensuring precision, superior quality, and cost optimization.As the global population continues to grow, increasing the demand for housing, Mivan technology offers an effective solution by accelerating construction timelines. It has become an indispensable method for high-density urban areas, providing faster project completion without compromising quality or cost-efficiency.

1.2 *Objective of the work*

1. Study Mivan formwork construction techniques, components, and design.
2. Evaluate its compatibility with modern construction practices.
3. Assess usability, strength, efficiency, and flexibility in complex projects.
4. Compare Mivan with timber, steel, and plastic formwork in terms of speed, cost, labor, and environmental impact.
5. Analyze time efficiency and suitability for large-scale, high-density projects.

1.3 *Scope of the work*

This study investigates Mivan formwork technology and its implications for the construction industry. It focuses on the effectiveness of this innovative system in achieving satisfactory construction outcomes. The analysis will include the advantages and disadvantages of Mivan formwork in comparison to conventional systems, emphasizing aspects such as cost, quality, duration, speed, and safety. Additionally, the study will perform a comparative analysis between Mivan and traditional formwork, examining construction speed, cost-effectiveness, labor requirements, and overall efficiency. It will also explore the components of Mivan formwork, detailing the assembly process and erection times to assess practical applications on construction sites. Furthermore, the research will consider the future prospects of Mivan technology, highlighting its potential for wider adoption among builders and owners, especially in high-rise and large-scale projects. Finally, the study aims to underscore the cost-saving and time-efficient benefits of Mivan formwork, demonstrating its relevance in modern construction practices.

2. LITERATURE REVIEW

2.1 *General*

This literature survey explores the research on Mivan formwork technology and its impact on the construction industry, particularly in the context of high-rise buildings. Mivan formwork technology, which uses prefabricated aluminum formwork panels, provides a highly efficient alternative to conventional formwork systems such as

timber or steel. research shows that the Mivan system enhances structural accuracy and minimizes waste, making it a sustainable option for large-scale construction projects.

2.2 *Literature review*

Yogesh Radheshyam Jangid et al. (2023) This study provides a comprehensive overview of Mivan formwork technology as an innovative system employing aluminum components, particularly suited for high-rise construction. It traces the evolution from traditional timber and steel formwork to aluminum, citing improvements in construction speed and cost-efficiency. The study identifies key advantages such as reduced construction time, enhanced build quality, and overall cost-effectiveness. Although the initial investment and the need for skilled labor are noted as limitations, the study includes comparative insights on structural performance and reusability when evaluated against other systems. Case studies within the research highlight the successful deployment of Mivan technology in large-scale projects, offering empirical support for its benefits.

Nitesh Baban Patekar et al.(2023) This paper emphasizes the continued reliance on conventional formwork due to its lower upfront costs and flexible design compatibility. However, it also points out drawbacks, including extended assembly time, higher labor demands, and substandard finish quality. In contrast, Mivan technology—developed for mass housing—offers significant improvements in terms of speed, quality, and reduced labor dependency. The research underscores the high reusability, strength, and quick assembly of aluminum formwork, which contribute to time and cost savings in large projects. Despite its higher initial cost, the technology proves economical in the long run. Furthermore, the study discusses the reduced environmental footprint of Mivan due to minimal waste and longer material life span compared to timber or steel alternatives.

Prof. Santosh Mahadev Kinayekar et al. (2023) This study explores Mivan technology's contribution to improving the efficiency and quality of precast structural components. It explains how Mivan enables the rapid and standardized production of durable concrete structures, making it ideal for high-rise and mass housing developments. The research supports the widespread use of this technology due to its time-saving and cost-reducing features, along with its alignment with sustainable building

Vedika Prasad Mahele et al. (2021) This paper highlights the increasing adoption of Mivan formwork in mass housing and high-rise buildings due to its speed, cost-effectiveness, and sustainability. Introduced in India during the 1990s, Mivan technology is recognized for its reusable aluminum components that reduce material waste and support environmentally responsible construction. The authors conduct detailed comparisons with conventional formwork in terms of time, cost, and labor efficiency using case studies and field research. They conclude that Mivan is particularly beneficial for large-scale urban projects, offering significant long-term advantages that outweigh the initial investment

Pramod Shinde et al. (2020) This review analyzes various formwork systems and their impact on construction efficiency. It focuses primarily on the comparison between traditional and Mivan systems, especially regarding cost implications. While Mivan requires a higher initial investment due to its specialized materials and design, it delivers long-term savings by reducing labor and expediting project timelines. The study highlights Mivan's ability to provide superior surface finish and structural quality. It also notes that project success is influenced by site conditions, worker expertise, and management practices. The paper advocates for skill development among workers to fully harness the benefits of Mivan technology.

Sumit Ghangus et al. (2018) This research introduces the components of Mivan formwork—such as wall panels, rocker supports, and stub pins—and explains how its lightweight aluminum structure aids in efficient installation and removal. The prefabricated nature of the system leads to faster construction cycles and quicker formwork turnover. The high reusability of Mivan (200–300 uses) compared to traditional systems (10–20 uses) significantly enhances its economic value over time. The system provides smooth concrete finishes, minimizing the need for additional plastering. Moreover, its performance under seismic conditions makes it favorable in earthquake-prone regions. The study does, however, acknowledge the higher initial cost as a potential barrier.

3.Mivan Technology

3.1 *General*

Modern construction method that uses aluminum formwork for the rapid and efficient construction of concrete structures. Originally developed by a European company named Mivan, this technology has gained popularity in countries like India, especially for mass housing projects and high-rise buildings.

3.2 *Advantages of Mivan Formwork*

1. Faster completion of floors Lesser number of joints and reduced leakages.
2. Smooth finishing of wall and slab
3. Low maintenance
4. More seismic resistance
5. Huge carpet area
6. Good quality construction work
7. Faster completion
8. No need for plastering

3.3 Disadvantages of Mivan Formwork

1. Alignment maintenance needs skilled laborers.
2. Initial setup takes time.
3. It is expensive and used for typical floors only.
4. It needs skilled laborers for alignment maintenance.
5. Construction joints should be set properly.

THE KEY USES OF MIVAN FORMWORK

- → Easy to operate within less time.
- → Includes the 3S scheme of construction to give strength, safety, and speed.
- → Slabs and walls are easily formed in one consistent development.
- → Assembling and fitting the part of shuttering.
- → Beam construction and column are removed.

3.4 *MAIN FEATURES OF MIVAN FORMWORK*

1. Aluminum Formwork.
2. Monolithic Construction.
3. Prefabricated Panels.
4. High Reusability
5. Smooth Finish

3.5 *Formwork- Components*

Mivan Formwork consists of many components which when connected to each using the drawing provided then it can be used for concreting, the material used for making these components are high strength aluminum alloy.

The main components of mivan are

1. Wall components
2. Beam components
3. Deck components
4. Other components

5 METHODOLOGY

MIVAN FORMWORK COMPONENTS

The standard component of the formwork is the panel, which consists of an extruded aluminum rail section, joined to an aluminum sheet. It generates a low weight panel having an outstanding stiffness to weight ratio and exhibits a minimal deflection with concrete load. Panels are fabricated in a given size and form to cater to the requirements of individual projects. The panels are made out of high strength aluminum alloy with a 4 mm thick skin plate and 6mm thick ribbing behind to stiffen the panels. The panels are produced in Mivan's dedicated factories in Europe and South East Asia. Upon assembly, they undergo a trial erection in an endeavour to remove any dimensional or on-site issues. The entire formwork components arrive at the site complaining three months from the time they are ordered. After are the components that are normally used in the construction.

5.1 Wall Components

a) Wall Panel: In Mivan formwork technology, the wall panel plays a crucial role as it forms the face of the wall during construction. These panels are crafted from high- grade aluminum sheets, which are meticulously cut and shaped to match the exact dimensions of the wall to be constructed. This precision in sizing ensures that the wall surfaces are smooth, uniform, and free from irregularities, enhancing the overall quality of the construction. The use of aluminum for the wall panels provides several advantages, including its lightweight nature, which makes handling and installation easier compared to conventional formwork materials like wood or steel. Additionally, aluminum's durability and resistance to corrosion contribute to the longevity of the formwork, allowing it to be reused multiple times, thereby improving cost-efficiency. By using wall panels designed for specific project requirements, Mivan formwork accelerates the construction process while maintaining a high level of accuracy and finish in the structural elements.

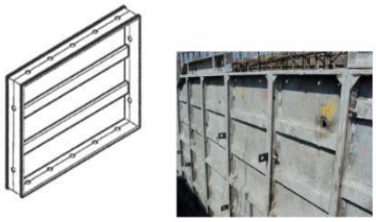

Fig 1 Wall Panel

b)Rocker: The rocker is an important support part of the Mivan formwork system. Its main job is to help strengthen the wall structure during construction. It's designed with special openings that allow stub pins to fit in securely, helping connect and align the panels properly. When concrete is poured, the rocker helps spread the load evenly, keeping the formwork firm and in place. This is crucial to avoid any shifting or movement while the concrete sets. Besides adding stability, the rocker also helps make the setup and removal of formwork faster and smoother—an important benefit in today's fast-moving construction projects.

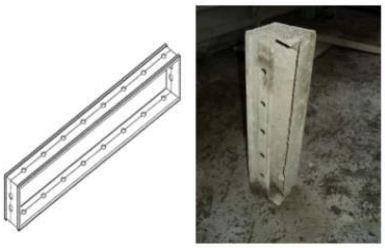

Fig 2 Rocker

c)Kicker: The kicker is placed at the top of the wall panels and acts like a ledge to keep everything firmly in position. When concrete is poured, the pressure can push panels out of alignment. The kicker helps stop that by holding the panels steady, making sure they stay straight and in the right place. This not only improves the quality of the wall but also reduces the chances of mistakes or the need for corrections. By keeping things aligned, the kicker plays a big role in achieving clean finishes and smoother workflow on site.

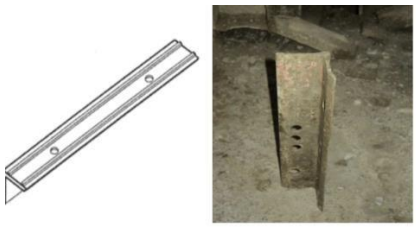

Fig 3 Kicker

d)*Stub Pin:* The stub pin is a small but essential part of the Mivan system. It connects two wall panels together securely, ensuring they stay properly aligned while concrete is being poured. Without it, panels might shift or become misaligned, affecting the quality of the finished wall. Stub pins also make it quicker and easier to assemble the formwork, which helps save time and labor on site. Because they make the process both faster and more reliable, stub pins are a key part of what makes the Mivan system so efficient and precise.

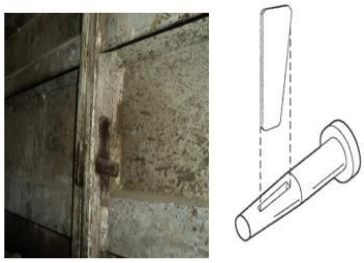

Fig 4 Stub pin

5.2 BEAM COMPONENTS

a) Beam Side Panel Beam Side Panel: The beam side panel is used to shape and support the vertical sides of a concrete beam while it is being poured. It holds the concrete in place so that the beam forms correctly and maintains its exact size. These panels are usually rectangular and are part of the Mivan formwork system, which helps speed up construction and ensures accuracy. While standard sizes are the norm they can be modified to suit various designs.

Fig 5 Beam Side Panel Beam Side Panel

b) Prop Head for Soffit Beam: The prop head holds the lower section of the beam referred to as the soffit when casting the concrete. It has a V-shape design that provides firm, stable support and maintains the shape of the beam while the concrete hardens. The design also enables easier and safer removal of the formwork without cracking the fresh concrete. Because it is adjustable, it can accommodate beams of various sizes, thus being great for a wide range of activities. It generally aids in accelerating the building process and decreases the amount of additional labor required.

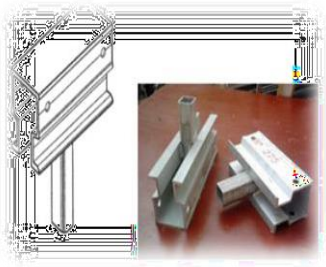

Fig 6 Prop Head for Soffit Beam

c)**Beam Soffit Panel**: The soffit panel constitutes the bottom of the beam and is level in the formwork system. It makes the bottom of the beam smooth and level and assists in maintaining the shape of the structure as the concrete cures. These panels are typically constructed of heavy-duty materials such as aluminum or steel that are capable of supporting the weight of wet concrete. In Mivan systems, panels are available in standard sizes so they can easily be installed and removed. When the concrete has set, they can be used again on another section of the project, conserving time and minimizing material wastage.

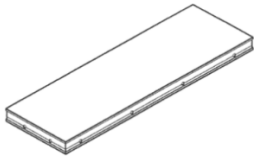

Fig 7 Beam Soffit Panel

d)Beam Soffit Bulkhead: The beam soffit bulkhead functions as an end cap of the beam to prevent concrete spilling out as it is poured. It provides vertical support and makes the terminal end of the beam clean and accurate in shape. These bulkheads are designed using strong materials such as aluminum, steel, or plywood and are compatible with the Mivan system.

Fig 8 Beam Soffit Bulkhead

5.3 DECK COMPONENT

a)Deck Panel: A deck panel is a key part of the formwork used to shape the horizontal surfaces of concrete slabs— like floors or roofs—while they are being cast. It holds the concrete in place as it sets, helping keep the surface flat and properly aligned. In Mivan construction, these panels are usually made of aluminum, which makes them strong but lightweight—easy to handle, install, and remove. They sit on top of supports like props and beams, helping distribute the weight of the wet concrete and avoid sagging. Because they're reusable, they help cut costs and reduce material waste. Their smooth finish also reduces the need for additional plastering. Special locking features help ensure the panels fit tightly, leaving no gaps and making sure the slab thickness stays even.

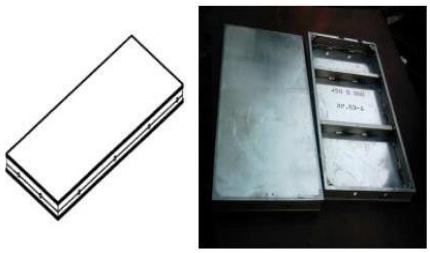

Fig 9 Deck Panel

b)Deck Prop: A deck prop is a vertical support used to hold up the deck panels while a concrete slab is being formed. It stays in place until the concrete becomes strong enough to support itself. These props are often adjustable in height and made of steel or aluminum to be both sturdy and lightweight. In Mivan systems, deck props help keep everything aligned and stable during the pour, preventing panels from moving or sagging. They are easy to use, reusable, and help save time and money on construction site.

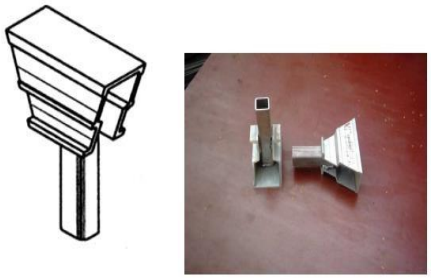

Fig 10 Deck Prop

c)Deck Mid Beam: A deck mid beam sits between the main beams and supports the formwork in the middle of a concrete slab. Its job is to carry and spread out the weight of the concrete to keep the surface level during pouring and setting. Usually made of steel or aluminum, this beam prevents the slab from bending or sagging in the middle. In Mivan systems, mid beams are designed for quick assembly and reuse, helping to build slabs of uniform thickness. They are especially useful in larger projects because they reduce the need for many props and make it easier for workers to move around the ground.

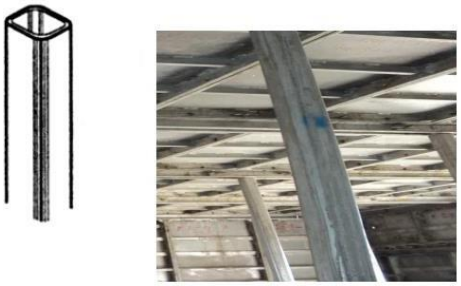

Fig 12 Deck Mid Beam

d)Soffit Length: Soffit length is the distance that defines the underside of a beam or slab in a formwork setup. It determines how wide the bottom area is that needs support during concrete pouring. In Mivan systems, the length depends on the structure's size and how much load it needs to carry. Accurate measurement is crucial—if it's off, it can lead to uneven surfaces or poor support. The soffit is held in place by elements like deck panels, props, and soffit panels, which all work together to maintain the form while the concrete sets. This length can be adjusted using different panels to fit different building designs.

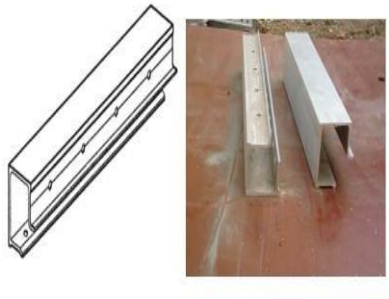

Fig 13 Soffit Length

e)Deck Beam Bar: Deck beam bars are steel rods placed inside beams and slabs to strengthen them. Concrete alone is strong under pressure (compression) but weak when stretched (tension). These bars handle the pulling forces so the structure doesn't crack or fail. In Mivan systems, the bars are carefully placed based on design plans. They're tied together before the concrete is poured, forming a strong internal skeleton. These bars help the structure resist bending, vibrations, and other forces from the environment or heavy loads.

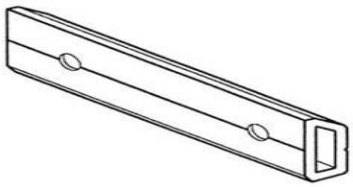

Fig 14 Deck Beam Bar

5.4 OTHER COMPONENTS

a)Internal Soffit Corner*:* An internal soffit corner is the place where a ceiling meets a wall from the inside, forming a neat joint. It helps hide elements like wires, air ducts, or beams while also giving the room a clean and finished look. In modern *construction methods like* Mivan formwork, these corners are made using precise aluminum molds, which produce smooth, sharp finishes. This reduces the need for extra plastering and speeds up the construction process, making the final result more uniform and professional-looking.

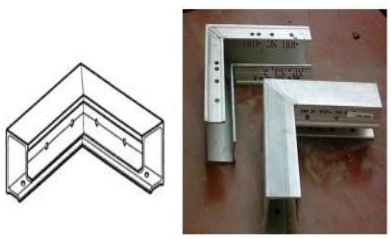

Fig 15 Internal soffit corner

b)External Soffit Corner: An external soffit corner is where the bottom edge of the roof (the soffit) meets the outer wall of a building, usually at the roof's overhang. It serves two main purposes: protecting the roof from weather damage (like rain or wind) and allowing air to circulate under the roof, which helps prevent moisture buildup. It also improves the building's overall appearance by creating a smooth and tidy edge. With Mivan formwork, these corners can be formed quickly and accurately.

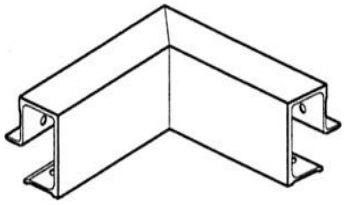

Fig 16 External Soffit corner

c)External Corner: An external corner is where two outer walls of a building come together, typically at a 90-degree angle. This corner is important for both the shape and strength of the structure. It needs to be sturdy to support the walls and aligned properly for a clean look.Using Mivan formwork, external corners are made with high accuracy. The system uses prefabricated aluminum panels, which ensures all corners are neat and consistent, saving time and reducing errors compared to traditional methods.

Fig 17 External Corner

d)Internal Corner: An internal corner is where two inside walls join. These are commonly found in every room and are important for both supporting the structure and maintaining the room layout. Well-built internal corners prevent cracks and allow for smooth wall finishes.Mivan technology helps create these corners with precision and minimal effort. Since the aluminum formwork gives a perfect shape to the concrete, there's little need for touch-ups afterward. This results in a faster, cleaner, and more reliable construction.

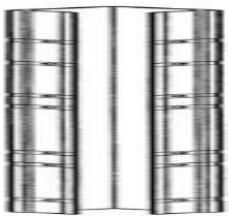

Fig 18 Internal Soffit

4. CONVENTIONAL FORMWORKS

Conventional formwork refers to the traditional method of constructing temporary molds or structures to support freshly poured concrete while it hardens and gains sufficient strength. Typically made from materials like timber, plywood, or steel, conventional formwork is known for its flexibility, allowing for diverse designs and custom shapes. This method, while versatile, is labor-intensive and requires skilled workmanship, leading to longer construction times and higher labor costs. Additionally, the assembly and dismantling process can be time-consuming, and the potential for inaccuracies in alignment or finishing may increase the need for rework. Despite these challenges, conventional formwork remains widely used, particularly in projects where customization and adaptability are key priorities, such as complex or smaller-scale structures.

Fig 19 Conventional formworks

6.1 COMPARISON BETWEEN MIVAN FORMWORK AND CONVENTIONAL FORMWORK SYSTEM

1. **Quality of surface finish**: Mivan formwork is known for giving buildings a very smooth and clean finish. Since it uses aluminium panels, the surface comes out neat and doesn't usually need extra plastering. This saves both time and money. On the other hand, traditional formwork often leaves rough or uneven surfaces, so extra plastering is usually needed to make it look good, which increases costs and delays the work.

2. **Pre-Planning of Formwork System**: Using Mivan formwork requires proper planning before construction starts. This includes getting the design right, planning the work schedule, and making sure all materials are ready on time. Without this preparation, things can go wrong during construction. Conventional formwork doesn't need this much planning and can be set up more freely, which might be okay for smaller projects but can cause problems in large-scale work.

3. **Type of Construction**: Mivan is mainly used for buildings where the walls and slabs are poured at the same time, creating a strong and continuous structure. This method makes the building more solid and durable. In contrast, conventional formwork is often used in RCC framed buildings where columns, beams, and slabs are made separately. This approach is less strong, especially during events like earthquakes.

4. **Wastage of Formwork Material**: One big plus of Mivan formwork is that it produces very little waste. Since the parts are pre-made to fit perfectly, there's not much cutting or trimming needed on-site. This saves material and reduces cleanup costs. Conventional formwork, especially when using wood or plywood, creates more waste because of manual adjustments and cutting.

5. **Accuracy in Construction**: Buildings made with Mivan formwork are usually more accurate in dimensions and alignment. The system is designed to be precise, which helps maintain quality throughout the project. In traditional formwork, accuracy depends on the skill of the workers and the materials used, so mistakes and uneven measurements are more likely.

6. **Coordination Between Different Agencies**:Mivan construction needs good teamwork between architects, engineers, and contractors. Everyone has to work closely to make sure the design, plumbing, electrical, and other systems all fit together properly. Traditional formwork is more flexible and doesn't require as much coordination, but this can sometimes lead to clashes or misalignments during construction.

7. **Resistance to Earthquake:** Because Mivan formwork creates a continuous, joint-free structure, it handles earthquakes better. The structure is more rigid and connected, making it stronger during shaking. In comparison, conventional buildings made with separate columns and beams might have weaker spots that can fail under earthquake stress.

8.Reusage value: Mivan formwork can be reused many times—up to 250 or even 300 times—which makes it a good investment for large projects. In contrast, traditional materials like timber and plywood wear out much faster and may only be reused 30–50 times, meaning you'll need to replace them more often, which adds to the cost.

Table 1 COMPARISON BETWEEN MIVAN FORMWORK AND CONVENTIONAL FORMWORK SYSTEM

Sl No	Characteristics	Mivan Formwork	Conventional Formwork
1	Speed of construction	Four days cycle per floor	Ten days cycle per floor
2	Quality of surface finish	Excellent plastering is not required	Bad
3	Pre-planning of formwork system	Required	Not Required
4	Type of construction	Cast in situ cellular construction	Simple RCC framed construction
5	Wastage of form work material	Very Less	In great amount
6	Accuracy in construction	Accurate construction	Less than Mivan
7	Coordination between different agencies	Essential	Not necessarily required

7.RESULT AND DISCUSSIONS

Mivan formwork technology has emerged as a game-changer in the construction industry, particularly for high-rise and mass housing projects. Its key advantages lie in speed, quality, and cost- effectiveness, which are crucial for addressing large- scale infrastructure challenges like India's affordable housing demand. The system utilizes prefabricated aluminum panels that are lightweight, durable, and designed for repeated use. This reduces the reliance on skilled labor and speeds up construction timelines considerably, often leading to project completion in half the time compared to conventional formwork systems. The precision and uniformity offered by Mivan formwork significantly improve the overall quality of construction. Walls and slabs cast using Mivan are monolithic, which enhances the structural integrity of buildings, reducing risks of leakage or cracks. Moreover, the smooth finishes achieved using this technology eliminate the need for extensive plastering, further reducing labor costs and material consumption. One of the most discussed aspects of Mivan technology is its cost-effectiveness in the long term. Though the initial investment in Mivan formwork is higher compared to traditional systems, the benefits of reuse (up to 250 times) spread these costs over multiple projects, making it highly economical for large-scale ventures. The rapid construction pace also reduces overhead costs, such as project supervision and rentals for scaffolding and cranes. Despite its advantages, Mivan formwork has limitations. It is most effective for repetitive layouts and uniform designs, which can constrain architectural creativity. Additionally, while highly efficient in large projects, it may not be cost-effective for smaller or irregularly shaped buildings. There is also a learning curve associated with its adoption, requiring proper training and careful coordination to avoid mistakes during assembly and disassembly.

8.CONCLUSSION

Mivan technology is an innovative construction technique that uses aluminium formwork to build buildings quicker and more accurately. It is used particularly for high-volume work like apartment blocks or estates where the same design is repeated over and over again. Perhaps the best thing is how much time and labor it saves. Because everything is so tidy and everything slots together so perfectly, the process of building is much quicker and more effective. This system also ensures that every unit is the same to view and operate, which is a good thing when you're building lots of the same houses.

Although the initial cost of Mivan formwork is higher than traditional processes, it is cheaper in the long run—especially for repetitive design. This is because one formwork type can be reused multiple times, even 250–300 times. Traditional formwork, however, is cheaper to start and more flexible, hence more suitable for single or small buildings. It, however, is slower to build with and less long- lasting.

Mivan formwork also increases the strength and quality of the building. It reduces delays and keeps construction cost under control through faster completion of each phase. Compared to traditional formwork, which can be used a few times, Mivan panels are extremely reusable and even possess scrap value after being used numerous times, further contributing to savings.

In a nation like India, where low-cost housing is in massive demand, Mivan technology is an excellent solution. It makes houses simple to construct and cheaper in the long run, with it being the perfect solution for massive housing schemes. Even research has concluded that for high-rise structures, Mivan is marginally more cost-effective—by about 3%—than conventional techniques. Due to this, Mivan is turning into a first-preference choice for projects where quality, affordability, and quickness are needed.

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