



Optimizing Construction Efficiency with Mivan Formwork System

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Abstract: Mivan technology, also known as Aluminum Formwork System, is a modern construction technique that utilizes aluminum formworks to create cast-in-place concrete structures efficiently. This method replaces traditional formwork made of wood or steel with lightweight and reusable aluminum panels, resulting in faster construction cycles, improved quality, and cost-effectiveness. Mivan technology is widely used in residential, commercial, and industrial projects due to its versatility, speed, and sustainability. Mivan technology used in India and its comparative analysis with conventional formwork with its cost, time and construction efficiency.

Index Terms – Mivan Aluminum sheets, Formwork cost, time, comparison, speed.

1. INTRODUCTION

A European construction company developed the aluminium formwork system called "Mivan". In 1990, Mivan Company Ltd. in Malaysia. Began to develop the process. The mould project covers more than 30,000 square meters. The construction industry is an important part of the Indian economy and an important part of its development. Today, India's urban population has become the second largest in the world and its future growth will increase the demand for housing, in which case it is necessary to plan land acquisition and rapid housing construction quickly. One of the most important factors that determine the success of the construction project in terms of speed, cost effectiveness and occupational safety is the structure used in the project, since it accounts for approximately 35% to 40% of all designs.

When considering the construction, the customer and the contractor want to finish it as soon as possible, and the customer wants the building to be used for its purpose as soon as possible. Contractors want the construction to be completed as soon as possible in order to earn more profit. The most effective way to increase the size of the building is to complete short construction. The construction time of the ground floor of the house is usually determined by the type of formwork because it is the most important time of construction. The construction industry is an important part of the Indian economy and an important part of its development. Mivan mould complies with IS 456:2000 standard. Mivan technology or Mivan formwork system is one of the best modern methods for the construction of large structures, especially in the duplication of slabs and blocks. This system is very popular in big cities at low cost.

2. HISTORY AND BACKGROUND

The Mivan Construction System, also known as Aluminium Formwork System, has its roots in Malaysia, where it was developed by a group of engineers in the late 20th century. The system was initially developed in Europe as Mivan Company Ltd. and conceived to address the challenges of traditional construction methods, particularly in the context of rapid urbanization and the growing demand for efficient and cost-effective building solutions.

The development of the Mivan system was driven by the need to streamline construction processes, reduce labour dependency, and enhance project timelines. Traditional formwork methods, characterized by timber and plywood, were time-consuming, labour-intensive, and prone to quality inconsistencies. The Mivan system sought to overcome these limitations by introducing an innovative approach that leveraged lightweight and durable aluminium formwork panels.

3. LITERATURE REVIEW

This is made and planned to do by reviewing some of the literature. The importance of reviewing the literature is to analysis the research works related to the study.

According to Mr. Shankar Bimal Banerjee, Mr. Pawan Dilip Barhate, Mr. Vipul Pradip Jaiswal and "Mivan Technology". This article attempts to give the readers a brief introduction to Mivan technology, the latest engineering formwork made from aluminium, and how the use of Mivan can save more rupees of time and money on the project. It is the best way to create high-, mid- and low-rise, large-scale real estate R/C models. It is a delicate design template made of aluminum. Monolithic pouring. Walls, columns, floors and beams are brought together. Speed - Demonstrates discipline and efficiency in construction, thus creating a daily work cycle, which is the key to efficiency.

It is based on "Research on Aluminum Formwork (Mivan Formwork) and Other Structures" by Sumit Ghangus. Commonly used wood and MS molds are very heavy and difficult to use for large areas; whereas aluminum formworks are lightweight and can be used in industry to create building structures, including walls. This type of aluminum molds are commonly known as Mivan molds in the industry. Mivan formwork is revolutionary in many stages of the construction industry and will reduce construction time, material usage, construction cost, increase the area of the building and most importantly increase the durability of the structure. These cases are examined and compared to understand how the two models differ and which of the two models is similar in terms of time, cost, and effort. Today, the fastest construction must be done in a short time in order to meet the housing needs of the increasing population and the increasing economy. in the construction industry. Formwork plays an important role in building construction.

Prof. Yadav P.D, Konnur BA, "Conformity Report for Construction and Examination of Mivan Formwork". The progress of economic development in any country can be evaluated as the development of that country. Concrete formwork is the use of support structures and molds inside the concrete that is poured to form the structure. There are many types of formwork used in construction and they often differ depending on the needs and challenges of the building. Templates account for approximately 35% to 40% of the cost required for RCC members. Proper documentation is necessary as molding accounts for a significant portion of the total cost.

Analysis and Comparison of Structural and Aluminum Formworks" by Shrikant M Harle. The fastest construction in a short time in order to meet the housing need brought by population growth and economic growth. In the construction industry, formwork plays an important role in building construction. It accounts for 60% of the time and 40% of the cost of the total project cost. We know the difficulty and waste of construction using the formwork method. Hence the invention of a new technology called the Mivan template system. In this article, we will first make a detailed examination of the traditional model and then touch upon the many disadvantages of this model.

4. PROBLEM STATEMENT

- 1) There are many stages and lengthy processes in Conventional Method.
- 2) More settling time in construction of Conventional members.
- 3) Wastage of Materials in Conventional construction.

5. AIM:

This study aims to compare the cost of building based on the cost of materials required in mivan and conventional construction, to carry out comparative analysis between the mivan and conventional method of construction.

6. OBJECTIVES:

- Compare the construction cost of the Mivan with the required material cost and the reference model.
- Comparison of Mivan and construction model.
- Determine the time required to complete construction using two methods.
- Explain the advantages and limitations of comparative methods through comparative analysis.

7. METHODOLOGY:



Fig No. 1 Aluminium Formwork

7.1 MIVAN construction / shuttering

- It depends on the drawing using X & Y direction [in right angle].
- The construction procedure in the case of MIVAN formwork is quite similar to the traditional type of formwork.
- The steps Involved in the MIVAN Formwork Construction are as follows:
 - a) Setting up the Wall reinforcing steel
 - b) Placing formwork
 - c) Pouring concrete

a) Setting up the Wall reinforcing steel:

- This is the first step, and in this step, in order to form the structure of the building, wall reinforcing steel is used.
 - Reinforcement used as per drawing starting from 8mm to 25mm.
 - 8mm for stirrups and slab
 - 16mm or 20 mm for beam and column
 - Cover used for column is 40mm, for beam is 25mm and for slab is 15mm.
 - For slab cover is used at bottom and cover for beam is used at both ends.
- Such types of steel reinforcement is Pre-casted in the factory itself and therefore they can be easily erected on the construction site.



Fig No. 2 Beam Reinforcing Steel

b) **Placing formwork**

- Since MIVAN formwork is a ready-made one, designing and manufacturing of Formwork take place in the factory itself as per the required sizes of columns, slabs, staircase, beams, and other structural elements of the buildings.
- Formwork is assembled on the site by the Pin and wedge system.
- Aluminum formwork used is of [ALUKO GROUP – HYUNDAI ALUMINUM CO. LTD.]
- For slab aluminum panel is of size 600*1200mm.
- Only formwork is of aluminum all other supports are of steel or iron.



Fig No. 3 Aluform Fixing

c) **Pouring concrete**

- After placing the Formwork, freshly made concrete is poured.
- Concrete used at site is flow-able concrete and regular concrete.
- Grade of concrete – M30 [30N/mm²]. A good quality concrete is used.
- Flow-able concrete is used in wall and columns.
- Regular concrete is used in slab and beam.
- After concrete is poured labour use rod for tamping and after that vibrators are used to avoid honeycombing.
- Concrete is poured in two layers.



Fig No. 4 Concrete Pouring

8. REVIEW STUDY

To design a multi-storey building

- Project Name :- Pari Towers
- Location :- NarheGaon, Pune
- Size Of Project :- 3,50,000 sq.ft
- Project Cost :- 69 cr
- Consultant :- JW Consultant
- Cycle :- 10 to 15 days cycle
- Storey :- G + 20 storey



Fig No. 5 Site Construction

9. ANALYSIS OF COST

Table 1: Total cost (Conventional Method)

| Sr. No | Particular | Conventional Method |
|--------|---------------|---------------------|
| 1 | Reinforcement | ₹ 60,80,97,000 /- |
| 2 | Concreting | ₹ 3,00,84,708/- |
| 3 | Brickwork | ₹ 1,93,23,412/- |
| 4 | Plaster | ₹ 3,17,45,394 /- |
| 5 | Formwork | ₹ 2,76,134/- |
| | Formwork | [10 Repetitions] |
| | TOTAL= | ₹ 68,95,26,648/- |

Table 2: Total cost (Mivan formwork)

| Sr. No | Particular | Mivan Method |
|--------|---------------|-------------------------|
| 1 | Reinforcement | ₹ 66,56,18,000/- |
| 2 | Concreting | ₹ 1,51,44,000/- |
| 3 | Brickwork | ₹ 0/- |
| 4 | Plaster | ₹0/- |
| 5 | Formwork | ₹ 37600/- |
| | Formwork | [200 Repetitions] |
| | TOTAL= | ₹ 68,07,99,600/- |

- Using Conventional Method Cost of the G+20 Floor Building :
(Single Floor Area=915.178 sq.m) = Rs ₹ 68, 95, 26, 648/-
- Using Mivan Method Cost of the G+20 Floor Building :
(Single Floor Area=915.178 sq.m)= Rs. ₹ 68, 07, 99, 600/-

Table 3: Comparison of cost by conventional and mivan method

| Sr.No | Particular | Conventional Method | Mivan Method | Cost Difference |
|-------|---------------|-------------------------|-------------------------|---|
| 1 | Reinforcement | ₹60,80,97,000/- | ₹66,56,18,000/- | - ₹ 5,75,21,000/- |
| 2 | Concreting | ₹ 3,00,84,708/- | ₹ 1,51,44,000/- | - ₹ 1,49,40,708/- |
| 3 | Brickwork | ₹ 1,93,23,412/- | ₹ 0/- | ₹ 1,93,23,412/- |
| 4 | Plaster | ₹ 3,17,45,394 /- | ₹0/- | ₹ 3,17,45,394 /- |
| 5 | Formwork | ₹ 2,76,134/- | ₹ 37600/- | ₹ 2,38,534/- |
| | Formwork | [10 Repetitions] | [200Repetitions] | |
| | TOTAL= | ₹ 68,95,26,648/- | ₹ 68,07,99,600/- | -₹ 2,11,54,368/- =3.072% Mivan is Economical |

10. TIME REQUIRED FOR CONSTRUCTION

Table 4: Conventional Method

| Sr.no. | Activity | No. of Days |
|--------|----------------------------|-------------|
| 1 | Column Shuttering | 48 |
| 2 | Column Steel-Reinforcement | 48 |
| 3 | Buffer | 8 |
| 4 | Beam & Slab Shuttering | 60 |
| 5 | Beam & Slab Steel Placing | 48 |
| 6 | Levelling | 12 |
| 7 | Concrete Placing | 24 |
| 8 | Removal of Formwork | 60 |
| 9 | Brickwork | 120 |
| 10 | Plastering | 120 |
| 11 | Finishing | 120 |
| | TOTAL= | 668 |

Table 5: Mivan Method

| Sr.no. | Activity | No. of Days |
|--------|------------------------------------|-------------|
| 1 | All Shuttering | 72 |
| 2 | Conceal Electrification & Plumbing | 72 |
| 3 | Steel Reinforcement | 24 |
| 4 | Alignment Checking | 12 |
| 5 | Buffer Time | 8 |
| 6 | Concrete Placing | 12 |
| 7 | Removal of Vertical Formwork | 8 |
| 8 | Removal of Other Formwork | 56 |
| 9 | Lifting of Wall Panel | 8 |
| 10 | Painting & Etc. | 80 |
| | TOTAL= | 352 |

The total duration for completion of G+20 building is faster by mivan method by 352 no. of days and the total no. of days saved are 316.

11. RESULT

By performing the cost comparison and by working on limitations we conclude that,

- The cost of material required by mivan construction is 3.072% more economical than conventional construction.
- It is concluded that time required for construction by mivan is relatively earlier than conventional method.
- It does not need plastering as it gives better finishing.
- By comparative analysis it is concluded that mivan is better in construction by speed, quality, construction time, maintenance cost and have more seismic resistance.

12. CONCLUSION

From the result obtained, Mivan Formwork is cost effective, time efficient and produces better quality if the quantum of work is more. Mivan Formwork System is a technique which is based on the concept of Modular Construction Techniques. Though initial investment is large, it is recommended for big projects as it compensates the cost with speedy construction and ultimately becomes more economic. Mivan Formwork is better for use in construction where time effective formwork is necessary. A floor cycle of 7-8 days is obtained with Mivan formwork and hence the whole project time is reduced significantly. It has been determined that building facilities produced utilizing mivan formwork technology are 3.072% Mivan is Economical than those built using the conventional method. This technology allows us to save a significant amount of time that's almost the half time while constructing high-rise structures.

13. REFERENCES

- 1) Mr. Shankar Bimal Banerjee, Mr. Pawan Dilip Barhate, Mr. Vipul Pradip Jaiswal, "Mivan Technology" Novateur Publications international Journal Of Innovations In Engineering Research And Technology [Ijiert]Issn: 2394-3696 Volume 2, Issue 3 March2015.
- 2) Sumit Ghangus "A Comparative Study of Aluminum Form Work (MIVAN Shuttering) with other Conventional Form Work" International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887Volume 6 Issue VI, June 2018- Available at www.ijraset.com.
- 3) Yadav P.D, Prof. Konnur B.A "Review Paper on Conventional and Mivan Formwork used for Construction" (2018) IJIRSET, Volume 7 Issue4.
- 4) Shrikant M Harle "Analysis Comparision of Conventional With Aluminium Formwork"Global Journal of Current Research in Urban Architecture and Regional Planning Vol 1, Issue 1 – 2018.
- 5) N.Kalithasan, K.Shanthi , B.Jose Ravindraraj , R.Vijayasarathy "Structural Design Of Aluminium Formwork Structure Over Framed Structure" International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST) Vol. 2, Issue 4, April 2016.
- 6) R. Thiyagarajan, V.Panneerselvam, K. Nagamani "Aluminium Formwork System Using In Highrise Buildings Construction"International Journal of Advanced Research in Engineering and Technology (IJARET) Volume 8, Issue 6, Nov - Dec 2017, pp. 29– 41, Article ID: IJARET_08_06_004.
- 7) Ninjal M. Parekh, Bhupendra M .Marvadi, Umang Patel "Comparative Studies Of Construction Techniques" Journal Of Information, Knowledge And Research In Civil Engineering ISSN: 0975 – 6744| NOV 14 TO OCT 15 | Volume 3, Issue 2.
- 8) Miss. Patil Dhanashri Suryakant, Prof. Desai D B. "Emerging Trends in Formwork - Cost Analysis & Effectiveness of Mivan Formwork over the Conventional Formwork" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684, PP: 27-30.

- 9) M.Sandeep, S.Suriya Prakash, M.Vetrivel, R.Ranjani, "Comparison of conventional building and mivan formwork building based on scheduling" Vol.-06(02) 2018 [1297-1299].
- 10) Mohammed Taher Al-ashwa, Redzuan Abdullah and Rozana Zakaria "Traditional formwork system sustainability performance" IOP Conf. Series: Materials Science and Engineering 271 (2017) 012108.

