



INTERNATIONAL RESEARCH JOURNAL OF MULTIDISCIPLINARY STUDIES & **SPPP's**,
Karmayogi Engineering College, Pandharpur Organize National Conference
Special Issue March 2016

Vol. 2, Special Issue 1, March, 2016 | ISSN (Online): 2454-8499 | Impact Factor: 1.3599(GIF),
0.679(IIFS)

MIVAN FORMWORK TECHNOLOGY

Sirse Guruling Ramling¹, Patil Yogendra.Ramesh²

¹Department of Civil Engineering Karmayogi Engineering College
Shelve, Pandharpur

Assist Prof ²Department of Civil Engineering Karmayogi Engineering College
Shelve, Pandharpur

Abstract- Construction is one of the significant sectors of Indian economy and is an integral part of the development. Today India's urban population is the second largest in the world and its future development leads to increased demand for housing to cope with this problem India should desperately need to plan for acquisition of land and rapid creation of dwelling units. Construction is a complex process involving basically the areas of Architectural planning, Engineering & Construction. There is growing realization today that speed of construction needs to be given greater importance especially for large housing projects. This is not only essential for the faster turnover of equipment and investment – leading possible to the reduction in the housing cost but also for achieving the national objective of creating a large stock to overcome shortest possible time. Fortunately, some of the advanced technologies catering to faster speed of construction are already available in the country. For e.g. Prefabrication, autoclaved blocks, tunnel formwork, aluminium formwork (MIVAN Technology) of construction etc. The aluminium formwork system was developed by Malaysian Company and that's why the aluminium formwork technology is named after it. Mivan is an aluminium formwork system used widely in the construction of residential units and mass housing projects. It is fast, simple, adaptable, durable and cost effective, produces total quality work which requires minimum maintenance. This system suitable for Indian condition as a tailor made aluminium formwork for cast-in-situ fully concrete structure. Mivan is new construction technology upcoming for successful completion of mass housing project in India. In this project we have discussed about cost comparison of mivan technology with conventional construction technology. The Mivan technology is absolutely fine with cost, quality and time saving as compare to conventional.

Keyword: cost effective, adaptable, time saving, & minimum maintenance etc.

1. INTRODUCTION

The Mivan Technology System was developed by Mivan Company Ltd from Malaysia late 1990s as a system for constructing mass housing project in developing countries. The units were to be of cast-in-place concrete, with load bearing walls using a formwork of aluminium panels. To be erected by the hundreds, of a repetitive design, the system

ensured a fast and economical method of construction. The concrete surface finish produced with the aluminium forms allows achievement of a high quality wall finish without the need for extensive plastering. This is one of the systems identified to be very much suitable for Indian conditions for mass construction, where quality and speed can be achieved at high level. The speed of

construction by this system will surpass speed of most of the other construction methods / technologies. Several systems are adopted at different places in the world; eventually the systems which are reasonably economical and easy for operation with skilled labor are useful in India. Certain systems are in vogue and more and more contractors are trying to bring in new technologies.

The progress made by the construction industry of any country could be considered as the index of development of that country. Further, the number of pucca houses built in any country could be another index. While there has been a progressive rise in stock of housing in India since independence, the speed thereof has not kept pace with the rapid growth of population and urbanization. As a result, the shortage of accommodation is increasing continuously and the situation has become acute in urban areas. The traditional mode of construction for individual houses comprising load bearing walls with an appropriate roof above or reinforced concrete (RC) framed structure construction with infill masonry walls would be totally inadequate for mass housing construction industry in view of the rapid rate of construction. Further, such constructions are prone to poor quality control even in case of contractors with substantial resources and experience.

2. Mivan system

It is the most advanced formwork systems. It is fast, simple and adaptable. It produces total quality work which requires minimum maintenance and when durability is the prime consideration. It is a totally pre-engineered

system where in the complete methodology is planned to the finest details. In this system the walls, columns and slab are casted in one continuous pour on concrete. Early removal of forms can be achieved by the air curing/ curing compounds. These forms are made strong and sturdy, fabricated with accuracy and easy to handle. The components are made out of aluminium and hence are very light weight. They afford large number of repetitions (around 250). The re-propping is simple hence short cycle time can be achieved.



MIVAN formwork can be used for a broad range of applications, from straight forward wall and slab construction to more complicated structures involving bay windows, stairs and A/C hoods. The MIVAN system for forming concrete structures is probably the most versatile modern construction system and unlike other system, it is equally suited to both high and rise construction. By using specially

designed and manufactured aluminium formwork and effectively managing associated construction activities, MIVAN has virtually brought 'assembly line' productivity to the construction site environment, completing projects in record times with four day per floor construction work cycle. Using this unique system, all walls, floor slabs, balconies, together with door and window openings are cast in place in single a site based operation. The resulting building structure is very strong, accurate in dimensions and tolerances, with high quality of finished concrete surface, and yet at the same time, the MIVAN Formwork Technology is fast, adaptable and very cost effective. The main characteristics of the MIVAN formwork technology is that it makes use of concrete as the principle building material for the prime reasons of cost and accessibility of cement, sand and stone are readily available in most countries. Concrete also brings additional benefits in terms of its build quality and strength, it is resistance to earthquake tremors, it is resistance to fire, rot and vermin attack; it is low noise transmission with good thermal capacity and it is proven durability, giving long life, with little maintenance.

2.1 Requirement of Mivan Formwork

The Mivan formwork is made up of of an aluminium alloy. While Construction is in process , the formwork is supposed to bear, besides its own weight, the weight of wet concrete, the live load due to labor, and the impact due to pouring concrete and workmen on it. The vibration caused due to vibrators used to compact the concrete should also be taken care off. Thus, the design of the

formwork considering its requirements is an essential part during the construction of the building. The Mivan Formwork should be able to take a live load including the impact about 370kg/m². It is however, usual to work with a small factor of safety in the design of formwork. The surfaces of formwork should be dressed in such a manner that after deflection due to weight of concrete and reinforcement, the surface remains horizontal, or as desired by the designer. The sheathing with full live load of 370 kg/m² should not deflect more than 0.25 cm and the joists with 200kg/m² of live load should not deflect more than 0.25cm. Maintaining the Integrity of the specifications. The modular nature of the mivan formwork should allow easy fixing and removal of formwork and the construction can proceed speedily with very little deviation in dimensional tolerances. Further, it should is quite flexible and can be easily adapted for any variations in the layout.

2.2 General specification of Mivan Formwork

The basic element of the Mivan Formwork is the panel, which is an extruded aluminium rail section, welded to an aluminium sheet. This produces a lightweight panel with an excellent stiffness to weight ratio, yielding minimal deflection under concrete loading. Panels are manufactured in the size and shape to suit the requirements of specific projects. The panels are made from high strength aluminium alloy with a 4 mm thick skin plate and 6mm thick ribbing behind to stiffen the panels. Earlier the panels were used to manufacture only in factories in Europe and South East Asia but in recent the formwork components are started manufacturing in india

as well e.g. COSMOS Construction Machineries And Equipments Pvt. Ltd . Once they are assembled they are subjected to a trial erection in order to eliminate any dimensional or on site problems. The formwork components are durable they can be used repetitively up to 200 times. It is light weighted so heavy lifting is eliminated, the heaviest components is of 25 kg, a labor can easily lift it.

3. Components Of Mivan Formwork

Sr. No	Parameter	Cost By Conventional Technology	Cost by Mivan Technology	Cost Saving
1.	Shuttering after repetitions	Wooden Materials =Rs. 88.50 /sq.m M. S. Material = Rs. 100.00/sq.m	Rs. 83.8/sq.m	Rs. 104.63/sq.m
2.	Concrete	Rs. 1400 /sq.m	Rs. 1505/sq.m	Rs. -105/sq.m
3.	Reinforcement	1,480.00	2,115.20	Rs-635.2/sq.m
4	Brickwork	484.00	0.00	Rs 480/sq.m
5	Plaster	700.00	0.00	Rs700/sq.m
6	Total cost saving			Rs. 548.43/sq.m

The basic element of the formwork is the panel, which is an extruded aluminium rail section, welded to an aluminium sheet. This produces a lightweight panel with an excellent stiffness to weight ratio, yielding minimal deflection under concrete loading. All the formwork components are received at the site within three months after they are ordered. Following are the components that are regularly used in the construction.

Fig:3.1 Wall panel.



Panels are manufactured in the size and shape to suit the requirements of specific projects. The panels are made from high strength aluminium alloy with a 4 mm thick skin plate and 6mm thick ribbing behind to stiffen the panels. The panels are manufactured in MIVAN'S dedicated factories in Europe and South East Asia. Once they are assembled they are subjected to a trial erection in order to eliminate any dimensional or on site problems.

Table 1: cost comparison between construction by conventional and mivan technology.



Fig 3.2 Beam component



Fig 3.3 Deck component

1.	Grade of Concrete	M 35
2.	Slump	180 – 200 mm
3.	Wall Thickness	External : 200 mm Internal : 100 mm
4.	Steel	Partition wall: 10 mm dia. Structural: 12 mm dia. Shear Wall : 16 mm dia.
5.	Slab Thickness	Hall : 175 mm Bedroom : 150 mm

4. COST COMPARISON

By adopting Mivan technology in the project not only it gives the better quality of construction and but also increases the speed of construction and reduces the cost since some of the construction activities are completely eliminated and others are reduced to a extent . This project includes the cost comparison of conventional construction with Mivan Technology of construction. The following comparison is from the data acquired at Paranjpe scheme’s “Blue Ridge” a 138 acre integrated township Hinjewadi , Pune.

4.1 Details about the structure

It is a part of Paranjpe schemes’s “Blue Ridge” a 138 acre integrated township Hinjewadi , Pune. We have acquired the data of Tower HA-1 (25 Floors).

5 HONEYCOMBING AND CRACKS IN SHEAR WALL

The mivan technology follows monolithic construction i.e. all the structural member viz. beam, shear wall, slab are casted at same time. In conventional construction the concrete is placed from height of 0.6 to 1 meter, and that is what recommended height to place the concrete. In Mivan Technology of construction the concrete is placed from height of 3 meter in shear wall and compacted using vibrator, now as height of placing concrete is more there are chances of segregation in concrete resulting in honeycombing and cracks in wall. In mivan construction it is generally happened that after removing formwork there is honeycombing in

shear wall, in this project we had tried to fix the problem of honeycombing in shear wall. We had gone to BASF The chemical company pertaining this problem; they suggested us to use the MasterGlenium ACE 30JP as admixture to concrete so as to increase the workability of concrete to reduce honeycombing

and increase the strength of concrete. One of the measures to check the workability of concrete is its slump and to check the strength is compressive strength. In this project we have compared the slump and strength of concrete using admixture and no admixture by slump cone test and compressive testing machine respectively. Following are the details .

A. Specification of MasterGlenium ACE 30JP

- Appearance : Brownish Liquid
- Specific Gravity: 1.00-1.02 g/cm³
- PH Value : 6-9

B. Concrete mix design

- Grade Designation: M35
- Type of Cement: OPC 53 Grades
- Reduced water content for admixture: 20 %
- Mix design
- Conventional concrete: 1:1.4:2.2

C. Slump cone test result

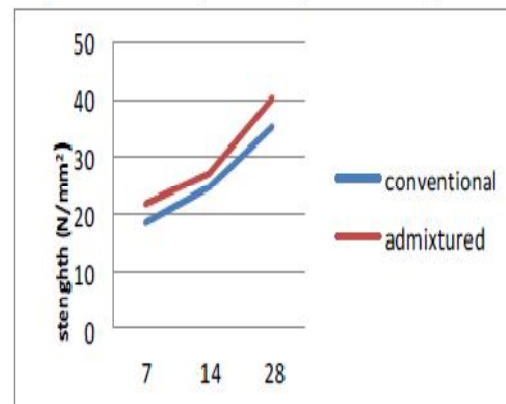
Sr.No.	Description	Slump
1.	Conventional concrete	100 mm from top
2.	Concrete using admixture	220 mm from top

D. Compressive strength testing result

Sr. No.	Day	Load (KN)		Strength (N/mm ²)	
		Conventional	Admixture d concrete	Conventional	Admixtured concrete
1.	7	414	453	18.40	20.17
2.	14	577	610	25.67	27.12
3.	28	798	902	35.48	40.12

By using admixture the workability of concrete is increased by 120 % whereas the strength of concrete is increased by 13 %

Graph 1: Result analysis of Compressive Strength Test



6. Advantages of Mivan formwork over conventional construction

1. More seismic resistance: - The box type construction provides more seismic resistance to the structure.
2. Increased durability: - The durability of a complete concrete structure is more than conventional brick bat masonry.
3. Lesser number of joints thereby reducing the leakages and enhancing the durability.
4. Higher carpet area- Due to shear walls the walls are thin thus increasing area.

5. Integral and smooth finishing of wall and slab- Smooth finish of aluminium can be seen vividly on walls.
6. Uniform quality of construction – Uniform grade of concrete is used.
7. Negligible maintenance – Strong built up of concrete needs no maintenance.
8. Faster completion – Unsurpassed construction speed can be achieved due to light weight of forms.
9. Lesser manual labour- Less labour is required for carrying formworks.
10. Simplified foundation design due to consistent load distribution.
11. The natural density of concrete wall result in better sound transmission coefficient.

7. Advantages Of Mivan

1. High quality formwork ensures consistence of dimensions.
2. On removal of mould a high quality concrete finish is produced to accurate tolerances and verticality.
3. Total system forms the complete concrete structures.
4. Custom designed to suit project requirements.
5. Unsurpassed construction speed.
6. Panels can be reused up to 250 time
7. Can be erected using unskilled labour.

8. Limitations Of Mivan

1. Because of small sizes finishing lines are seen on the concrete surfaces.
2. Concealed services become difficult due to small thickness of components.
3. It requires uniform planning as well as uniform elevations to be cost effective.

4. Modifications are not possible as all members are cast in RCC.

9. CONCLUSION

The task of housing due to the rising population of the country is becoming increasingly monumental. In terms of technical capabilities to face this challenge, the potential is enormous; it only needs to be judiciously exploited.

Traditionally, construction firms all over the world have been slow to adopt the innovation and changes. Contractors are a conservative lot. It is the need of time to analyze the depth of the problem and find effective solutions. Our aim is to serve as a cost effective and efficient tool to solve the problems of the mega housing project all over the world. Our aim is to maximize the use of modern construction techniques and equipments on its entire project.

We have tried to cover each and every aspect related to conventional and aluminium form construction. We thus infer that aluminium form construction is able to provide high quality construction at unbelievable speed and at reasonable cost. This technology has great potential for application in India to provide affordable housing to its rising population.

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 may preferred even if at the higher initial cost.

10. FUTURE SCOPES

This thesis work is restricted to only Mivan formwork and not other type of aluminium formworks. The future researchers can continue by working over other type of formworks construction by analyzing activities like brickwork, plastering, painting and many more. Furthermore interviews of different people from construction industry can be taken based on questionnaire prepared and analysis can be done.

11 References:

[1]http://www.avighnagroup.com/downloads/avighna_press_archi_july11.pdf

[2] [http://www.replify.com/wp-content/uploads/2010/07/Construction-Case - Study-Mivan.pdf](http://www.replify.com/wp-content/uploads/2010/07/Construction-Case-Study-Mivan.pdf)

[3]http://www.mivan.com/modular/Mivan_Modular.pdf

[4] <http://www.iosrjournals.org/iosr-jmce/papers/sicete%28civil%29-volum e3/30.pdf>