

## “Emerging Trends in Formwork - Cost Analysis & Effectiveness of Mivan Formwork over the Conventional Formwork”

Miss. Patil Dhanashri Suryakant<sup>1</sup>, Prof. Desai D B<sup>2</sup>

<sup>1</sup>(Student, Civil Department, Dr. J J Magdum College Of Engineering Jaysingpur, Maharashtra)

<sup>2</sup>(HOD, Department Of Civil Engg, Dr. J J Magdum College Of Engineering Jaysingpur, Maharashtra)

**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, aluminum formwork (MIVAN Technology) of construction etc. This paper describes the comparative analysis of conventional formwork and tailor made formwork on the basis of cost and time parameter.

**KEYWORDS:** – Cost effectiveness, Time effectiveness, Quality control, Quantity parameter.

### Objective of study

To compare the conventional formwork & aluminium formwork on the basis of

- 1) Cost Parameter,
- 2) Time parameter,
- 3) Quality Parameter,
- 4) Quantity Parameter.

### Relevance of study

Concrete formwork is the use of support structures and moulds to create structures out of concrete which is poured into the moulds. There are many different types of formwork used in construction, usually differing according to what the building requirements and challenges are. Formwork is used by creating moulds out of wood, steel, aluminum or prefabricated forms into which the concrete is poured. This is then allowed to harden and set after which it is stripped, or in the case of stay-in-place formwork it is left as part of the structure. Formwork allows contractors to cast and construct the main parts of a building which are required to be strong and support the structure such as floors and walls, as well as smaller parts of a building such as stairs relatively quickly.

## I. INTRODUCTION

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.

**“For undertaking mass housing works, it is necessary to have innovative technologies which are capable of fast rate construction and are able to deliver good quality and durable structure in cost effective manner.”**

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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.

### **1.1 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.



Fig1.Mivan Formwork

### **1.2 Components Of Mivan Formwork**

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. 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.

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 2.Wall panel



Fig 3.Beam Component



Fig.4 Deck Component

## **II. A CASE STUDY**

### **GODREJ GARDEN ENCLAVE**

The Construction division of Godrej and Boyce Mfg. Co. Ltd. has been launched its Godrej Garden Enclave B-type Towers. The Proposed Towers are about 32 level towers with 28 habitable levels. It shall have large 2-Bhk, 3-BHK and 4-BHK penthouses with premium amenities and finishes, along with basement, stilt and podium car parking and refreshing surroundings.

#### **Project Details-**

**Client:** - Godrej and Boyce Mfg. Co. Ltd. Vikhroli, Mumbai

**Consultant:** - T. Khareghat

**Contractor:** - Mazada Construction Pvt. Ltd.

**Built up area:-** 14731 sqm

**Floor space index:-** 1.33

**Construction Cost:-** 4200 per sq.ft

In cost saving analysis, we got the results as total project cost for mivan formwork as 11,34,66,865/- and total project cost for Conventional Formwork (Wooden) as 12,07,94,200/-.So cost saving by mivan formwork is 73,27,335/- and total Time saving by using mivan formwork are 6 months than using conventional formwork(wooden).

#### **2.1 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.

#### **2.2 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.

#### **2.3 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 caste in RCC.

5. Large volume of work is necessary to be cost effective i.e. at least 200 repetitions of the forms should be possible at work.
6. The formwork requires number of spacer, wall ties etc. which are placed @ 2 feet c/c; these create problems such as seepage, leakages during monsoon.
7. Due to box-type construction shrinkage cracks are likely to appear.
8. Heat of Hydration is high due to shear walls.

### **III.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.

### **IV.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.

### **V. LIMITATIONS**

During our site visit discussion with site people we found that the People usually have a large work load and lot of responsibilities. Employees involved at workplace are very reluctant and when asked questions they feel that their confidentiality is breached. Thus people are reluctant to share the information of the key business processes due to confidentiality and other issues. In this way it forms barrier to re-engineering.

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