



## Time and Cost Optimization of Construction Project using Mivan Technology

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# Time, Cost and Speed Optimization of Construction by Mivan Technology

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Construction is one of the significant sectors and integral part of Indian economy. Also, it is of the important parameter in development of country. India is desperately planning for rapid manufacturing and creation of dwelling units for economical construction facilities. Formwork enables to cast and construct the important elements and components of any construction facilities, which are required to be strong and effectively handle the structure. Mivan is comparatively a new construction technology upcoming for successful completion of mass project especially repetitive in nature. In this paper we have discussed about cost as well as time comparison of mivan technology with conventional formwork technology. The Mivan technology is appreciably efficient with cost, quality and time saving as compare to conventional one. The basic ideology is to reach conclusion regarding the superiority of the two techniques over another.

“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.”

## ***Introduction***

India, being the second largest urban populated nation in the world, there is an increase in demand for housing in India. Thus high rise buildings are gaining popularity. Aluminium formwork system is successfully used in Japan, Singapore,

Malaysia and Middle East countries. It has significant advantages over conventional techniques such as speed, strength and cost saving on mass construction. 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”. Several systems are adopted at different places in the world; eventually the systems which are reasonably economical and easy for operation with skilled labour are useful in India. Certain systems are in vogue and more and more contractors are trying to bring in new technologies. These are essentially based on the basis of mode of construction, namely, pre-cast construction or in-situ construction.

## ***Formwork***

When concrete is placed, it is in plastic state. It requires to be supported by temporary supports and castings of desired shape till it becomes sufficiently strong to support its own weight. This temporary casing is known as the formwork or forms or shuttering. The term moulds is sometimes used to indicate formwork of relatively small units such as lintels, cornices etc.

## ***Definition of formwork***

“Forms or moulds or shutters are the receptacles in which concrete is placed, so that it will have desired shape or outline when hardened. Once concrete develops the adequate strength to support its own weight they can be taken out”.

“Formwork is the term given to either temporary or permanent moulds into which concrete or similar materials are poured”.

### **Requirements of a good formwork**

The essential requirements of formwork or shuttering are: -

- a) It should be strong enough to take the dead and live loads during construction.
- b) The joints in the formwork should be rigid so that the bulging, twisting, or sagging due to dead and live load is as small as possible. Excessive deformation may disfigure the surface of concrete.
- c) The construction lines in the formwork should be true and the surface plane so that the cost finishing the surface of concrete on removing the shuttering is the least.
- d) The formwork should be easily removable without damage to itself so that it could be used repeatedly.

## ***3. Construction Activities with Mivan Formwork***

The construction activities are divided as pre – concrete activities, during concreting and post – concrete activities.

They are as follows:

### **3.1 Pre – Concrete Activities**

- a) Receipt of Equipment on Site – The equipment is received in the site as ordered.
- b) Level Surveys – Level checking are made to maintain horizontal level check.
- c) Setting Out – The setting out of the formwork is done.
- d) Control / Correction of Deviation – Deviation or any correction are carried out.
- e) Erect Formwork – The formwork is erected on site.
- f) Erect Deck Formwork – Deck is erected for labours to work.
- g) Setting Kickers – kickers are provided over the beam.

After the above activities have been completed it is necessary to check the following.

- 1) All formwork should be cleaned and coated with approved realize agent.
- 2) Ensure wall formwork is erected to the setting out lines.
- 3) Check all openings are of correct dimensions, not twist.
- 4) Check all horizontal formwork (deck soffit, and beam soffit etc.) in level.
- 5) Ensure deck and beam props are vertical and there is vertical movement in the prop lengths.
- 6) Check wall ties, pins and wedges are all in position and secure.
- 7) Any surplus material or items to be cleared from the area to be cast.

8) Ensure working platform brackets are securely fastened to the concrete.

### 3.2 On Concrete Activities

At least two operatives should be on standby during concreting for checking pins, wedges and wall ties as the pour is in progress.

Pins, wedges or wall ties missing could lead to a movement of the formwork and possibility of the formwork being damaged.

This affected area will then require remedial work after striking of the formwork.

#### Things to look for during concreting:

- 1) Dislodging of pins / wedges due to vibration.
- 2) Beam / deck props adjacent to drop areas slipping due to vibration.
- 3) Ensure all bracing at special areas slipping due to vibration.
- 4) Overspill of concrete at window opening etc.

### 3.3 Post – Concrete Activities

- 1) Strike Wall Form- It is required to strike down the wall form.
- 2) Strike Deck Form- The deck form is then removed.
- 3) Clean, Transport and stack formwork
- 4) Strike Kicker Formwork – The kicker removed.
- 5) Strike wall – Mounted on a Working Platform the wall fitted on next floor.

6) Erect Wall – Mount Working Platform and the wall is erected. normally all formwork can be struck after 12 hours.

#### The post – concreting activities includes:

Cleaning All components should be cleaned with scrapers and wire brushes as soon as they are struck. Wire brush is to be used on side rails only.

The longer cleaning is delayed, the more difficult the task will be. It is usually best to clean panels in the area where they are struck.

**Transporting:** There are basic three methods recommended when transporting to the next floor:

- 1) The heaviest and the longest, which is a full height wall panel, can be carried up the nearest stairway.
- 2) Passes through void areas.
- 3) Rose through slots specially formed in the floor slab for this purpose. Once they have served their purpose they are closed by casting in concrete filter

#### Striking

Once cleaned and transported to the next point of erection, panels should be stacked at right place and in right order. Proper stacking is a clean sign of a wall – managed operation greatly aids the next sequence of erection as well as prevents clutters and impend other activities

## **Objective of Study**

- 1) To compare the cost of building by using conventional formwork technique & by using MIVAN formwork technique.
- 2) To compare the Duration of building by using conventional formwork technique & by using MIVAN formwork technique.
- 3) To carry out which formwork is best for construction of building.
- 4) To understand the concept of MIVAN formwork All above mention points will have been studied on alive case study.

## ***4.Comparison of Mivan formwork system with Conventional Construction***

The below shows the relative comparison between the Mivan form work system and the conventional system. The comparison is made on the factors such as speed of construction, quality of construction, aesthetics, external finishes and maintenance.

### **Speed of construction**

The speed of construction is much slower due to step by step completion of different stages of the activities such as erection of formwork, concreting and deshuttering and thereafter plastering and other finishing activities. In this system the wall and the floors are casted simultaneously in one continuous operation and also the finishing work can be started immediately, so the speed of the construction is much faster.

### **Quality**

Due to conventional method of construction normal quality is obtained.

Superior quality is obtained due to in-situ casting of whole structure and transverse walls done in continuous operation

### **Aesthetics**

In the case of conventional construction partition walls are made up of bricks due to which the column and the beam show unsightly projections in room interiors. In case of Mivan system the partition and the ceiling elements are casted together due to which the interiors have neat and clean lines without unsightly projections in various corners. The wall and the ceilings also have a smooth even surface.

### **External finishes**

All the external walls are made up of bricks, so it requires manual cement plastering which needs to be repainted frequently. All the external walls are made up of concrete and do not require manual cement plastering and also have smooth finishing, so this will need no frequent repainting.

### **Maintenance**

The maintenance cost is too high as it requires frequent repairs of plasters of wall and ceilings, painting of outer and inner walls due to leakages. The maintenance cost is negligible as the walls and ceiling are made up of high quality concrete which do not require frequent repairs.

## Cost Comparison

Comparison on the basis of the on site survey conducted at Jaypee Krescent Homes Noida UP. Details of the building: This project is a part of the massive housing project at sec.135 Noida UP.

The name of the project whole project is Jaypee Wish Town, and the survey is carried out on the Jaypee Crescent Homes tower no.30. Here are the details of the building.

- 1) Grade of concrete: M25
- 2) Slump: 180mm-200mm
- 3) Wall thickness External:150mm;  
Internal:120mm
- 4)Steel:  
Partitionwall:8mm;  
Structural:16,20,25mm;  
ShearWall:8,10mm
- 5)Slab thickness: Hall=100mm;  
Bedroom:100mm;  
Kitchen:100mm
- 6)Finishing:  
Internal: Paint over gypsum;  
External: Texture paint
- 7) No. of floor : 11 Floors

## ***5.Comparison based on time Work cycle***

MIVAN is a system for scheduling & controlling the work of other connected construction trades such as steel reinforcement, concrete placements & electrical inserts.

The work at site hence follows a particular sequence.

The work cycle begins with the deshuttering of the panels.

It takes about 12-15hrs.

It is followed by positioning of the brackets & platforms on the level.

It takes about 10-15hrs simultaneously.

The deshuttered panels are lifted & fixed on the floor .

The activity requires 7-10 hrs Kicker and External shutters are fixed in 7 hrs.

The wall shutters are erected in 6-8 hrs.

One of the major activity reinforcement requires 10-12 hrs.

The fixing of the electrical conduits takes about 10 hrs and finally pouring of concrete takes place in these.

This is a well synchronized work cycle for a period of 7 days.

A period of 10-12 hrs is left after concreting for the concrete to gain strength before the beginning of the next cycle.

The formwork assembling at the site is a quick & easy process.

On leaving the MIVAN factory all panels are clearly labeled to ensure that they are easily identifiable on site and can be smoothly fitted together using formwork modulation drawings.

All formwork begins from corners and proceeds from there. The system usually follows a four day cycle: -

Day 1: -The first activity consists of erection of vertical reinforcement bars and one side of the vertical formwork for the entire floor or a part of one floor.

Day 2: -The second activity involves erection of the second side of the vertical formwork and formwork for the floor

Day 3: - Fixing reinforcement bars for floor slabs and casting of walls and slabs.

Day 4:- Removal of vertical form work panels after 24hours, leaving the props in place for 7

days and floor slab formwork in place for 2.5 days.

## **A CASE STUDY OF PMRDA HOUSING SCHEME**

PMRDA has been launched its AFFORDABLE HOUSING SCHEME for EWS and LIG group under PMAY scheme. The Proposed Towers are of G+11 story. It shall have 1-BHK and 2-BHK with premium amenities and finishes, along with car parking and refreshing surroundings. Project Details

Client: - PMRDA

Consultant: CEPL

Contractor: - Yashnand Engineers and Contractors Pvt. Ltd.

Built up area :- 540000

Floor space index :- 1.5

Construction Cost :- 1611 / 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).

## **Conclusion:**

We thus conclude that mivan formwork construction is able to provide high quality construction at unbelievable speed at reasonable cost. This mivan technology has great potential for application in India to provide affordable housing to its rising population.

## **Referances:**

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