

Analysis and Comparison of Mivan Formwork System with Conventional Formwork System

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Abstract – In this day, to fulfill the need of shelter of population growth and increasing industrialization, fastest construction need at the short time. In construction industry Formwork act upon key role in construction. It constitutes 60% time and 40% cost of the total project value. We know the difficulties & wastage in construction by using conventional formwork system. So there is New Technology invented named Mivan Formwork System. In this paper we done with detailed study of Conventional Formwork firstly and after that we passed out so many Drawbacks for this Formwork. Then we started detailed study of Mivan Formwork system and overcome the drawbacks of conventional formwork system so that we are achieved final conclusion of the paper.

Key Words: Mivan Formwork, Conventional Formwork, Cost, Time, Quality.

1. INTRODUCTION

Civil Engineering is an ancient art of construction of building. As the time is goes on revolution in Construction Technology was seen step by step. In any construction there are a numerous activity which play crucial roles like Formwork, Roofing, Concreting, Steel Reinforcement, Finishing, Furniture Work, etc. In accordance with these activities we choose the subject of analysis of formwork construction. Indian Construction Industry is known for its use of Conventional Formwork System and it hasn't adopted advanced formwork system in RCC Construction when compared to other major countries.

Now the scenario of construction field is much different, but the study is needed in order to choose the suitable Formwork with different perspectives. Cost, times are the basic parameters but along with that we should also focus on quality, safety and construction waste generation during the process. Currently in India other types of Formworks are also available.

1.1 Conventional Formwork

Formworks are the moulds and dies that hold the concrete and carry the weight of materials, workers and equipment and for construction of reinforced concrete superstructure in building projects. The conventional

(Traditional) formwork system usually consists of standard plywood panels tied together with timber frame over their backs with horizontal members called walling to resisting the weight and horizontal force of wet concrete. A careful handling of the wall forms is needed as it is considered susceptible to edge and corner damage. There is a need to choose a formwork type as there are different systems because they have their advantages and disadvantages. Cheap conventional formwork is time consuming to use for larger structures.



Fig. No.1 Conventional Formwork.

Process of Formwork Construction

1. Propping and centering.
2. Shuttering.
3. Provision of camber.
4. Cleaning and surface treatment

Des shuttering:

Des shuttering in simple means, the process of removing the shuttering (Formwork for Concrete).

1. Order and method of removing formwork.
2. Shuttering forming vertical faces of walls, beams & column sides should be removed first. Shuttering forming soffit to slab should be removed next.
3. Shuttering forming soffit to beams, girders or other heavily loaded members should be removed in the end.

Period of Removal of Formwork

| Sr.No | Description of structural member | Time Period |
|-------|--|-------------|
| 1. | Walls, columns and vertical sides of beams | 1 to 2 days |
| 2. | Slabs (props left under) | 3 days |
| 3. | Beam soffits (props left under) | 7 days |
| 4. | Removal of props to slabs | |
| | (a) For slabs spanning upto 4.5 m | 7 days |
| | (b) For slabs spanning over 4.5 m | 14 days |
| 5. | Removal of props to beams and arches | |
| | (a) Spanning upto 6 m | 14 days |
| | (b) spanning over 6 m | 21 days |

Advantages conventional formwork :

1. It has easy handling as it is light weight.
2. It is easy shutter and de-shutter.
3. Damaged Parts can be replaced with new ones.
4. It has good thermal insulation, which makes it to be useful in cold region.

Disadvantages Conventional Formwork :

1. It has less repetitions.
2. Dry timber absorbs moisture from wet concrete.
3. Timber experiences the shrinkage after many uses.

1.2 Mivan Formwork

The system of aluminum forms (MIVAN) has been used widely in the construction of residential units and mass housing projects. It is fast, simple, adaptable and cost – effective. It produces total quality work which requires minimum maintenance and when durability is the prime consideration. This system is most suitable for Indian condition as a tailor-made aluminum formwork for cast-in-situ fully concrete structure.

Mivan formwork assembly

The simplicity of Aluminum Formwork and the tedious idea of the get together process make it conceivable to precisely program construction successions and along these lines process durations well ahead of time. Furthermore, this empowers the untalented work to work

with the formwork, along these lines lessening the weight on talented work when this is hard to come by. On leaving the manufacturing plant, all boards are plainly named to guarantee that they are effectively identifiable on location and can be easily fitted together utilizing the formwork regulation illustrations. MIVAN points utilizing present day construction procedures and gear in the entirety of its projects. On leaving the MIVAN manufacturing plant all boards' region obviously marked to guarantee that they are effectively identifiable on location and can be easily fitted together utilizing the formwork balance illustrations. All formwork creatures at corner and continues from that point.

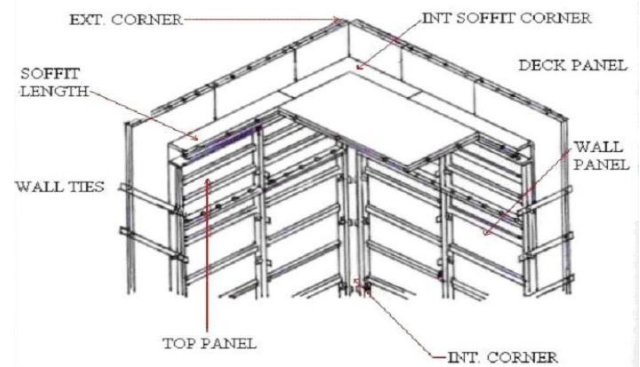


Fig. No.2 Mivan formwork assembly

Workcycle

Mivan is the system for the scheduling and controlling crafted by other associated construction patterns, for example, steel fortified solid arrangements the work cycle takes after specific grouping. It is takes after by situating of the sections and stage on the level. This activity requires 7 to 10 hrs. Kickers and external suit are fixed in 7 hrs. The wall shutters are erected in 6hrs. Major activates of reinforcement required the 10 to 12 hrs. The fixing bob electric conduit is about and finally pouring of concrete take place. This is very much synchronized cycle for a time of 7 days a time of 10 to 12 hrs. is left in the wake of cementing for the solid to pick up quality before the start of the following cycle the formwork collected nearby sides speedy and simple process. On leaving the mivan processing plant all boards are plainly to guarantee that they are effortlessly distinguished nearby and can easily fitted.

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.

Advantages:

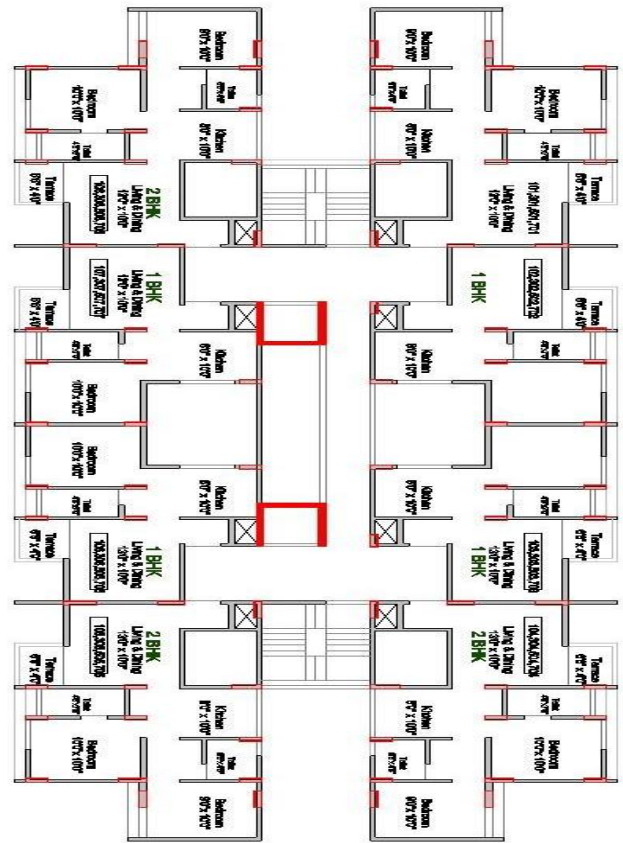
1. It completely forms concrete structure.
2. Custom designed to suit the project requirements.
3. High quality finishing along with speed.
4. It can be used repeatedly up to 150 times.
5. High Salvage Value of Formwork is achieved after the use.

Disadvantages:

1. Its initial cost and setup time is higher than conventional formwork.
2. The overall project duration of is same as that taken by the conventional formwork
3. Skilled labor is required.
4. It is not economic if number of repetitions is less.

2. Comparison Of Mivan Formwork System With Conventional Formwork System

For comparison of conventional formwork and mivan formwork we collect plan of G+19 and design for both conventional and mivan formwork. In this design we use the data like cost, duration of activities, material types and rates from market survey and various design aspects from above case studies.



Rate Analysis by Conventional Formwork

Total Shuttering Quantity Required For One Floor

| Sr. No. | Name of the component | Quantity (In Sq m) |
|---------|-----------------------|--------------------|
| 1. | Slab | 439.89 |
| 2. | Column | 421.86 |
| 3. | Beam | 77.42 |
| | Total | 578.49 |

| Sr. no | Material | Quantity | Unit | Rate (rs) | Amount (rs) |
|--------|-------------|----------|-------|-----------|-------------|
| 1 | Plywood | 600 | Nos | 1600 | 960000 |
| 2 | Props | 1300 | Nos | 1300 | 1,690,000 |
| 3 | Nails | 114 | Kg | 60 | 6840 |
| 4 | Grease oil | 191 | Litre | 30 | 5730 |
| 5 | Square pipe | 600 | Nos | 292 | 175200 |
| 6 | U jack | 1091 | Nos | 250 | 68750 |
| 7 | Sinkaja | 500 | Nos | 100 | 50,000 |
| 8 | Patti | 875 | Nos | 20 | 175,000 |
| 9 | Channel | 327 | Nos | 1400 | 457800 |
| | | | | Total = | 3431820 |

Total cost of shuttering = 6603150/-

No of floors = 20

$$\text{Rate of Conventional Formwork} = \frac{6603150}{11570}$$

$$\text{Rate of Conventional Formwork} = 571 \frac{\text{INR}}{\text{sq.mtr}}$$

After 150 Repetition By Conventional Formwork

Rate of Conventional Formwork After 150 repetitions

$$= \frac{32131250}{150 * 578.5}$$

Rate of Conventional Formwork After 150 repetitions

$$= 370 \frac{INR}{sq. mtr}$$

Rate Analysis By Mivan Formwork

Total shuttering quantity required for one floor

| Sr. no. | Name of the component | Quantity (In Sq m) |
|---------|-----------------------|--------------------|
| 1. | Slab | 457.89 |
| 2. | Column | 421.86 |
| 3. | Beam | 56.95 |
| 4. | Wall | 116.92 |
| | Total | 1053.62 |

| Sr No | Discription Of Item | Quantity | Unit |
|-------|------------------------------|----------|----------|
| 1 | Shuttering Area Of One Floor | 1053.62 | SQ M |
| 2 | Number Of Floor | 20 | |
| 3 | Total Shuttering Area | 21072.4 | SQ M |
| 4 | Price For The Shuttering | 7400 | PER SQ M |
| 5 | B U A Of One Floor | 578.49 | SQ M |
| 6 | B U A Of All Floors | 11569.8 | SQ M |

Rate of Mivan Formwork

$$= \text{shuttering area}$$

$$* \text{rate per unit area}$$

$$= 1053.62 * 7400$$

$$\text{Rate of Mivan Formwork} = 7796788 \frac{INR}{sq. m}$$

Material Cost Per Sq M B.U.A

$$\text{Rate of Mivan Formwork} = \frac{\text{Total cost}}{\text{Built up area}}$$

$$= \frac{7796788}{11570}$$

$$\text{Rate of Mivan Formwork} = 674 \frac{INR}{sq. m}$$

After 150 Repetitions By Mivan Formwork

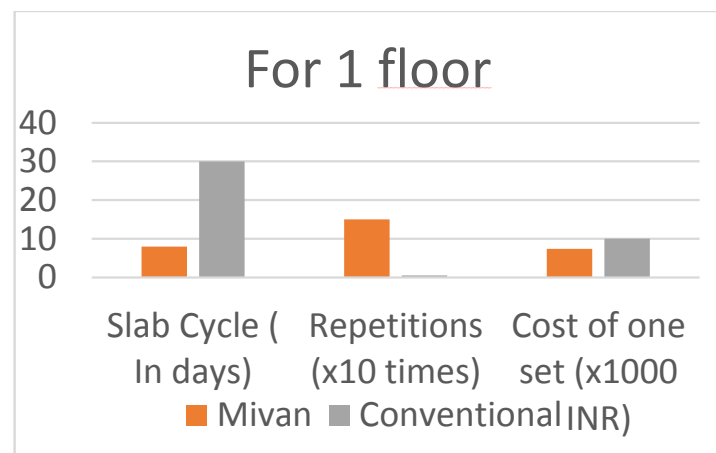
Rate of Mivan Formwork After 150 repetitions

$$= \frac{7796788}{150 * 578.5}$$

Rate of mivan Formwork after 150 Repetitions = 90Rs/Sq.m

Productivity

Considering the factors viz. Slab Cycle, No. of repetitions of a set of formworks and the cost of one set of the formwork used to construct 1 floor of area is mentioned below in the graph.



The above-mentioned details used to calculate the productivity of a specific Formwork System. The data for the Conventional Formwork System, Mivan System and Tunnel Form System is analyzed to figure out the productivity of the Formwork system.

$$\text{Productivity} = \text{Slab Cycle} * \text{Repetition} * \text{Cost of one set}$$

As per the analysis, Conventional Formwork System has productivity of around 15000000, Mivan System has productivity around 8880000.

Comparison Table

| Sr No | Parameters | Conventional | Mivan |
|-------|------------------------------|------------------------------|------------------------------|
| 1. | Initial Investment | Low | High |
| 2. | Repetition | 5 | 150 |
| 3. | Durability | Low | High |
| 4. | Quality Of Surface Finish | Bad. Plastering is Required. | Excellent. |
| 5. | Labour | Semi-skilled | Skilled |
| 6. | Cycle Time | 28 Days | 8 Days |
| 7. | Economy In Construction | Economical On Small Scale. | Economical For Mass Housing. |
| 8. | Wastage Of Formwork Material | More | Very Less |
| 9. | Scrap value | No | 30% of initial cost |

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.

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