

# Interpretation of Relevant Formworks on Site Constructions

S.P. Atpadkar<sup>1</sup>, S.S.Shweta<sup>2</sup>, R.S.Kognole<sup>3</sup>, S.S.Deshpande<sup>4</sup>

<sup>1,2,3,4</sup>Dept of Civil Engineering

<sup>1,2,3,4</sup>TSSM'S BSCOER,Savitribai Phule Pune University, Pune, Maharashtra

**Abstract-** At the 21st century, it has been ever increasing demand for construction industry a second largest sector after agriculture. Thus, with increase in demand for constructions it has also ever increased the demand for materials required for dwelling the construction process. Formwork is an important part of construction & it takes 25-60% of total cost of construction. Thus, with the use of new technologies in formwork construction permits casting of larger elements in a single pour with reduced time & labor required as compared to that of conventional methods. An effort is made in this issue to give a broad treatment to this vast, intricate and interesting subject that is "Formwork in Construction". All the basic criteria for selection of formwork types are given emphasis so as to select ecofriendly materials with cost reduction & speedy work

**Keywords-** Sustainable materials, cost reduction, Eco-friendly

formworks for columns, beams...etc. when the same elements are repeating.

The structural system of temporary supports that holds the formwork in position is termed as false work. Formwork is also an effective means of curing when it is left in place. The operation of removing the formwork is known as stripping. Stripped formwork can be reused. Reusable forms are known as panel forms and non-usable ones are called stationary form. The erection of formwork is a time consuming process and cost of formwork (material + labour) could sometimes be as high as 50% of the cost of the concrete structure. The failure of formwork systems during construction, causing monetary and time loss, sometimes grave injuries and death, are not uncommon. Efficient design of these temporary structures play critical role in reducing the cost and ensuring safety.

## I. INTRODUCTION

In present era of modernization & new trends in construction it has become a foremost need to adopt automated methods in construction so as to complete the desired work in predefined duration. In context to this we know formwork plays an important role in time completion & quality of elements constructed. Formwork is the term given to either temporary or permanent molds into which concrete or similar materials are poured. In the context of concrete construction, the false work supports the shuttering molds that enables molding of concrete into desired shape, holds it in the correct position until it has hardened sufficiently and is able to support the loads imposed on it. The most important factor in terms of cost, quality and speed in a high-rise building construction project is the type of the formwork used in the project. The first formwork type to be used is the conventional type formwork where the timber planks were supported on timber columns. With the advancement of technology it developed gradually and people used ply wood sheets instead of timber planks and steel pipes with jacks were used to support the ply wood. Then people invented small units of formworks and connect the repeating units in the construction. The larger units were invented like formworks for slab panels,

## II. IDENTIFY, RESEARCH AND COLLECT IDEA

A successful project is known by its advanced or automated constructions with speedy work & their great accuracy. Following step study was carried out for interpretation of relevant formwork on site.

Stage I- Detailed classification of formwork & formwork systems

### 1. Conventional material (Timber) Formwork Systems:

A combination of plywood and timber are used to create these traditional/conventional formwork systems at the construction location.

### 2. Modern method (Aluminium Formwork Systems):

This type of formwork can be used repeatedly for constructing different types of structures/components.

### 3. Recent innovation (Table form systems):

A table form/flying form is a large pre-assembled formwork and false work unit, often forming a complete

bay of suspended floor slab. It offers mobility and quick installation for construction projects with regular plan layouts or long repetitive structures and hence is highly suitable for flat slab, and beam and slab layouts.

#### 4. New trend (Jump form Systems):

The formwork supports itself on the concrete cast earlier; so does not rely on support or access from other parts of the building or permanent works. Jump form system (including systems often described as climbing form), is suitable for construction of multi-storey vertical concrete elements in high-rise structures such as Shear walls, Core walls, Lift shafts, Stair shafts, etc.

#### 5. High rise Slip form Systems:

Slip form is similar in nature and application to jump form, but the formwork is raised vertically in a continuous process. Acoustic Permanent

#### 6. Insulated Formwork Systems:

Insulating concrete forms (ICF) are typically used to construct permanent insulated formwork systems. Such formwork is usually assembled at the construction site

### Stage II- Selection of appropriate formwork & systems

1. Design Related-
  - a. The shape of the building
  - b. Design of the external wall
  - c. Internal Layout
  - d. Structural Forms
  - e. Consistency in Building dimensions
  - f. High head-room, Large spans etc.
2. Construction Related:
  - a. Site Complexities
  - b. Required speed of work.
  - c. Desired repeatability of formwork.
  - d. Area or Volume of cast per hour.
  - e. Availability of accurate construction plan/arrangement.
  - f. Type and number of lifting and transporting equipment available.
  - g. Involvement of other construction techniques like post-tensioning, prefabrication etc.

### Stage III- Requirement of good formwork

- Should be strong enough to withstand all types of dead and live loads; resist the pressure of the fresh concrete without damage or excessive deflection.
- Should be rigidly constructed, efficiently propped, braced both horizontally and vertically, so as to retain its shape and to avoid bows/bulges outside the tolerances specified for the work.
- Should be constructed accurately to ensure correct surface levels, dimensions
- exposed to the environment.
- Should be robust to allow repeated stripping, storing and erection and also permit removal of various parts in desired sequences without any damage to the concrete.
- Should rest on firm base.
- Should be economic, easily available and suitable for reuse.
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### Stage IV- Importance of use of sustainable material

- a) Since past days in construction field people used to continue the formwork & scaffolding process using the convention methods & materials like steel plates, timber.
- b) But this lead to cutting of number of trees leading to deforestation in nearby area of construction project. Also the timber formwork can be used for hardly 6-7 number of times.
- c) Thus initial investment was too high in this adoption of conventional methods also wastage & deforestation lead to environmental effects.

Thus evolution of new materials has taken place in formwork using sustainable materials.

- d) The use of sustainable materials like Aluminium panel, ply sheets, Polypropylene platform panels has helped to increase the use of eco-friendly materials in construction.

### III. IDENTIFY, RESEARCH AND COLLECT IDEA

- 1) Suitability for high rise construction-
  - a) Conventional material- Not suitable for high rise.
  - b) Sustainable material- Suitable for high rise multi-storied buildings.
- 2) Handling-

- a) Conventional material- Rough & unsafe
  - b) Sustainable material- Smooth & easy
- 3) Aesthetics-
- a) Conventional material- Ashtetically not good
  - b) Sustainable material- Ashtetically good & pleasant
- 4) Training required
- a) Conventional material- Not required
  - b) Sustainable material- Required
- 5) Manpower required
- a) Conventional material- High manpower required
  - b) Sustainable material- Low manpower required
- 6) Durability
- a) Conventional material- Less durable
  - b) Sustainable material- High durability
- 7) System
- a) Conventional material- Shuttering is restricted or fixed
  - b) Sustainable material- Shuttering is modular
- 8) Applications
- e) Conventional material- Minor construction works
  - f) Sustainable material- Mass housing & high rise buildings

Table I.Economy of formwork

SR N O.	PROPERTY	CONVENTIONA L MATERIAL	SUSTAINABL E METHOD
1	Initial Investment	Low	High
2	Props & Accessories cost	Not included in formwork	Included in formwork
3	Labour cost	High (More labours required)	Low (Less labours required)
4	Running cost	High	Low
5	Repetition cost	Very high	Medium

Table II. Re-usage value of formwork-

SrNo.	Formworktype	Reusage value of formwork
1	CONVENTIONAL MATERIAL	15-25 times
2	SUSTAINABLE METHOD	300-400 times

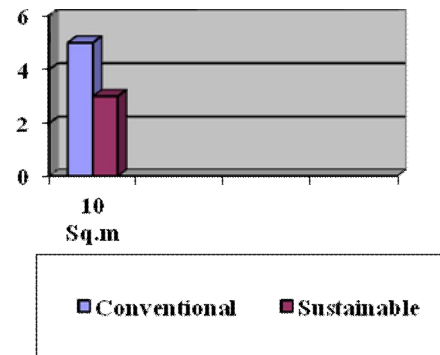


Figure 1. Speed of construction (10 m<sup>2</sup> of work in days)

**IV. DISCUSSION**

After focusing on all the elaborated points above it can be concluded, which type of formwork for the respective work & functions can be selected. Criteria’s considered for selection of formwork material types are as described below with wide elaborating the comparison of conventional & sustainable formwork materials. The sustainable material used for formwork here refers to Mivan formworks. The material basis for conventional considered is Timber, plywood, steel & those for sustainable is Aluminium panel, ply sheets, Polypropylene plasform panels.

**V. CONCLUSION**

Thus, it is clear from above discussion that the use of sustainable formwork materials is of great advantageous for rapidly rising structures providing benefits over conventional formworks. All the 13 aspects focusing on advantages of sustainable materials over conventional has been described in details thereby providing proper method to be adopted in construction. As automation is on great need & extent now-a-days, it's of great importance to adopt such eco-friendly methods & materials for construction in present Global warming era. This will also reduce the carbon emission in atmosphere thus reducing the chances of addition of pollutants in atmosphere.

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## REFERENCES

- [1] Ketan Shah, (2005) "Modular formwork for faster, economical and quality Construction", Indian Concrete Journal, Vol-79
- [2] Ashok Mandal, (2006) "Scaffolding & Formwork-Maintenance & Safety", CE &CR, August 2006, Vol.11
- [3] "Comparison of the use of Traditional and Modern Formwork Systems" Swapnali M. Karke1, M.B. Kumathekar