

## To Study About Comparative Techniques of Formwork to Manage Cost of Construction

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### Abstract

Construction industry is part of development for the India economy contributes a large Investment in plant, Equipment and Facilities to generate a best service or product. Today requirements of mass housing are rapidly increase due migration from Rural to Urban area. Thus with the globalization of Indian economy & introduction of multinational companies in India, it has become mandatory to have accurate & speedy construction project. Conventional Methods are not able to fulfil the demand of high rise building with high degree of quality. In spite of some conventional methods proved to be economical in past years unless the new construction techniques was invented but they fail in providing number of required dwelling in time. Advance technique is one of the remedy which helps to reduces time and labour cost of project and it also helps to construct required number of dwelling in sufficient time. In this study, attempt is made to have comparative study of conventional formwork technology with set of advance formwork techniques, which are currently not much used in Indian construction industry; and hence suggest which method is superior for the construction project.

**Keywords:** Comparative formwork techniques, cost, Reduction of cost.

### 1. Introduction

With the use of advanced technology, it becomes necessary to determine its impact in any form for a construction industry at regular intervals. Formwork by name means “The Mold” which means it is the casing into which the casting material, usually concrete, is poured to obtain the desired structural shape. In construction industry formwork is similar to a mold to cast concrete member in different shape and sizes using different types of materials such as timber, steel, aluminium, plastic, etc. Shuttering is a synonym term used for form-work. Formwork should have sufficient strength to carry dead load and live load coming on it during casting operation and after that till concrete gets hard and gain some percentage of design strength.

### Types of Formwork

- Timber Formwork: The Timber formwork is one of the mostly used in construction industry, fabricated on site using timber. Timber is easy to fix, remove and lightweight. Timber Shuttering is most flexible type of shuttering; it can be used for any shape and size.
- Steel Formwork: Steel formwork is popular due to its multiple time reuses. Steel formwork is costly but can be used for large number of projects. Steel shuttering give moderate finishes to concrete surface. It is suitable for circular or curved structures such as underground water tanks, columns below plinth, chimneys, sewer, tunnel and retaining wall.

- Aluminium Formwork: Aluminium formwork is similar in many respects similar to those made of steel. Aluminium formworks are lighter than steel forms due to low density and this is their primary advantage when compared to steel. The shuttering is economical if large numbers of repeating usage are made in construction. The disadvantage is that no alteration is possible once the formwork is constructed.
- Peri Formwork: Peri form work is a lightweight modular, interlocking system and can be used more than 200 times. It can be used for simple concrete structures. This type of shuttering is becoming popular for similar shape and large housing scheme.

## 2. Study Area Profile

Ahmedabad is the largest city in Gujarat and the administrative capital of Ahmedabad district. It serves as the seat of Gujarat High Court and is the seventh largest metropolitan area in India. Ahmedabad is an important economic and industrial hub and is reported to be one of the fastest growing cities of the decade (Forbe's 2010). Textile, pharmaceuticals and automobile are the most prominent industries based in and around Ahmedabad. In addition, there has been significant advancement of the IT sector as well, as the many prestigious higher-education institutes in the city continue to attract a large pool of highly skilled young professionals. In terms of transport infrastructure, Ahmedabad has a successful BRT system in operation, and a proposed metro-rail set to open in 2018.

Ahmedabad being the largest city in Gujarat, and also administrative capital of Ahmedabad district, have several well-known landmarks such as Civil Hospital (biggest hospital in Asia), BRTS system, Sabarmati Riverfront, Kankariya Lake etc., and it should be noticed that most of them are developed in last decade which shows remarkable use of technology and equipments in construction. There are about 815 developers and contractors in the City according to AUDA, and about 250 ongoing large projects. The tallest residential building "Takshashila Air" is under construction near Sabarmati River. Some major projects like metro rail from Ahmedabad to Gandhinagar, GIFT City, Bullet train from Ahmedabad to Mumbai, which could be more advantageous towards regional development.

## 3. Methodology

An attempt has been made in this paper to decide the best suitable technique for a particular project by comparatively studying these techniques and then establish a correlation cost parameters between these techniques. This will be achieved in following stages:

- Choose a typical floor plan and calculate the slab along with their respective areas.
- Decide the various formwork techniques that can be adopted and analyse cost/m<sup>2</sup> of the same.
- Prepare comparative statement including factors like economy, speed construction, strength etc.
- Calculate the overall cost required for various formwork techniques considering various cost stated in comparative statement.

## 4. Data Collection

The project undertaken for the study is EWS housing being constructed in Science City, Ahmedabad. The Purpose of the construction of this housing colony is to provide housing at economical rate. In addition to this, survey was carried out on different projects in and around Ahmedabad, with all the factors leading to the cost of various types of formworks, like cost of materials, labours, props, accessories etc., based on which a comparative statement is prepared. Some of these projects are Pradhanmantri Avas Yojana, Shivalik Shilp 2, Manor Greenz, Savvy Swaraj.

**Table 1: Site Details**

PROJECT DETAILS	
<b>Name of Project</b>	EWS Housing Scheme
<b>Type of Project</b>	Residential Building
<b>Location</b>	Science City
<b>Developer Firm</b>	Ahmedabad Municipality Corporation
<b>Contractor</b>	M. V. Omni Contractor Pvt Ltd
<b>Architect</b>	L J Purani
<b>Type of Contract</b>	Turn Key Contract
<b>Project Cost</b>	39 crore
<b>Total area of construction</b>	25113.76 m <sup>2</sup>

## 5. Data Collection

**Table 2: Data Collection of Different Formwork**

Sr. No	Parameter	Conventional Method		Advance Technique	
		Timber Formwork	Steel Formwork	Aluminium Formwork	Peri Formwork
1.	<b>Cost (Rs.)</b>				
	Initial Investment	Low	Moderate	High	High
	Initial Cost / m <sup>2</sup>	1000	2500	4500	5200
	Props & Accessories Cost / m <sup>2</sup>	Included in Formwork	Included in Formwork	Included in Formwork	Included in Formwork
	Transportation Cost	Included in Formwork	Included in Formwork	Included in Formwork	Included in Formwork
	Labour Cost / m <sup>2</sup>	30	28	40	40
2.	<b>Repetition Cycle</b>	15	50	140	185

	Repetition cost / m <sup>2</sup>	67	50	32	28
3.	<b>Cycle Time for 100 m<sup>2</sup> area (Days)</b>	5	7	3	2
4.	<b>Strength (KN/m<sup>2</sup>)</b>	30	45	60	67
5.	<b>Durability</b>	Low	Moderately High	High	High
6.	<b>Surface Finishing</b>	Average	Rough	Good	Fair Finished
7.	<b>Wastage of Material for 200 m<sup>2</sup> area (%)</b>	12	10	8	5
8.	<b>Planning of system</b>	Not Required	Not Required	Required	Required
9.	<b>Accuracy in construction</b>	Medium	Less	High	Superior
10.	<b>Manpower Requirement</b>	Medium	Medium	Less	Less
11.	<b>Training Programs</b>	Not Required	Not Required	Required	Required

## 6. Data Analysis

Total area of formwork required = 25113.76 m<sup>2</sup>

- Overall cost of Timber Formwork,  

$$= [\text{Area} * (\text{Repetition Cost} + \text{Labour Cost})]$$

$$= [25113.76 * (67 + 30)]$$

$$= \mathbf{2436034.72 \text{ Rs.}}$$
- Overall cost of Steel Formwork,  

$$= [\text{Area} * (\text{Repetition Cost} + \text{Labour Cost})]$$

$$= [25113.76 * (50 + 28)]$$

$$= \mathbf{1958873.28 \text{ Rs.}}$$
- Overall cost of Aluminium Formwork,  

$$= [\text{Area} * (\text{Repetition Cost} + \text{Labour Cost})]$$

$$= [25113.76 * (32 + 40)]$$

$$= \mathbf{1808190.72 \text{ Rs}}$$
- Overall cost of Peri Formwork,  

$$= [\text{Area} * (\text{Repetition Cost} + \text{Labour Cost})]$$

$$= [25113.76 * (28 + 40)]$$

$$= \mathbf{1707735.68 \text{ Rs}}$$

## 7. Conclusion

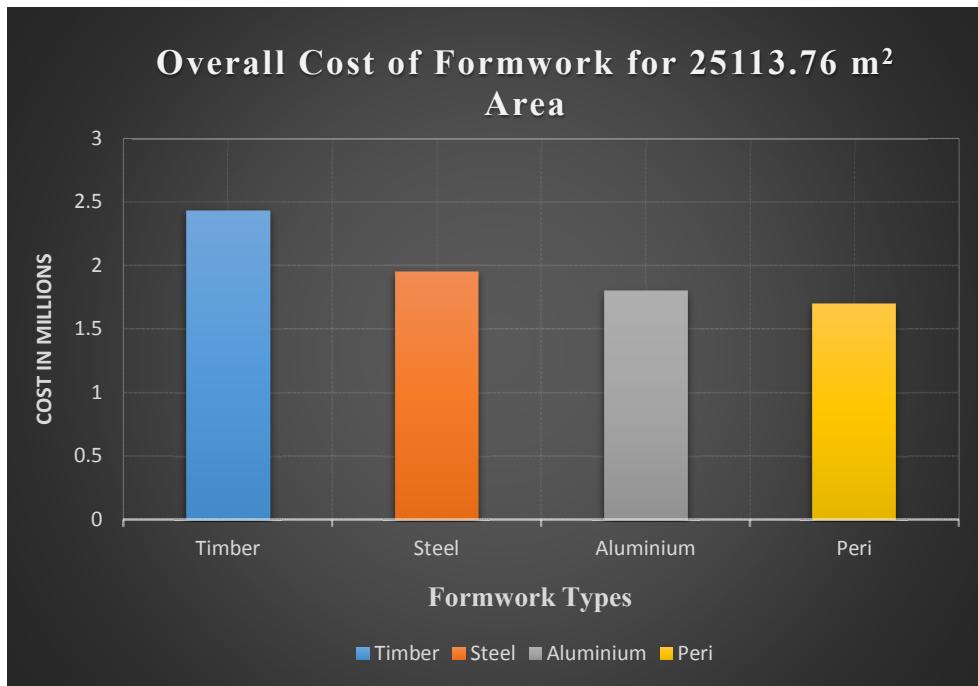


Chart 1 - Cost comparison of different formwork

On the basis of result obtained, it can be concluded that for the study project Peri formwork seems to be best solution for the project. Although Timber and steel formwork seems to be very expensive for this project, whereas cost of Aluminium formwork is quite more than Peri formwork. Due to quite high cost of Aluminium formwork is not suitable for this project even Aluminium formwork is generally used for repetitive type of construction such as construction of mass housing with repetitive design like LIG Housing, MIG Housing, HIG Housing. Whereas initial cost of Peri formwork is high but it proves to be economical after such number of repetition.

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