

# Study of Tunnel Formwork versus Aluminium Formwork.

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**Abstract** - For any successful project there should be proper planning, detailed thinking, and good management. Along with that construction methodology & technology is also very important nowadays. In construction one of the important factors is formwork. The cost of formworks is much higher than we consider it in project cost; it is around 20-25% of the project cost. The quality of construction mostly depends on the formwork used. Now a day to cast RCC load bearing structure in a monolithic way, advance formwork technologies like Tunnel formwork, Aluminium formwork and Doka formwork is used. It includes the walls, beams and the slab to be cast monolithically. This paper aimed at studying the Tunnel Formwork and Aluminium Formwork and compare on basis of time & cost parameters.

**Key Words:** Aluminium formwork, Monolithic structure, Quality of Construction, slab cycle, Tunnel formwork.

## 1. INTRODUCTION

Formwork is nothing but a temporary mould which supports and gives desired shape to fresh concrete. Fresh concrete is supported until it gains its strength to withstand by its own. It should have the capacity to carry dead as well as live load apart from its own weight. While selecting formwork for any construction some points should kept in mind for better output viz containment, strength, resistance to leakage, accuracy, time cycle, finish and reuse potential, access for concerted & economy.

In traditional formwork system timber or plywood is used, which has very low repetitions, finish is not that good and strength of formwork is too weak. Then to overcome these issues another formwork introduced i.e aluminium formwork, repetitions are quite good, finish is also good and strength wise also better. But its pin and wedge system is not that efficient and time consuming. So the Tunnel Formwork introduced in the industry. Outstanding performance of this Tunnel formwork with

high grade of concrete gives fabulous output than conventional and aluminium formwork.

## 2. OBJECTIVE

Objective of study is to study and compare formwork systems and give best suggestion of formwork for different construction practices on the basis of:-

- i. Speed of construction.
- ii. Cost parameters.
- iii. Quality/ Finishing in construction.

## 3. CONTENTS

Formwork planning process is divided in 3 stages.

Stage 1: Information, data collection and examination of limiting conditions.

Stage 2: Analysis of system & choice of system based on information collected

Stage 3: Use of system in construction.

Depending upon purpose of use, method of erection various types of formwork systems are selected. There are different types of formwork available for different purposes. Generally, the formworks for vertical concreting are called wall forms and those for horizontal concreting are called slab or floor forms. These formwork systems varies from conventional to advanced MIVAN, TUNNEL formwork systems having slab cycle of 1-3 days

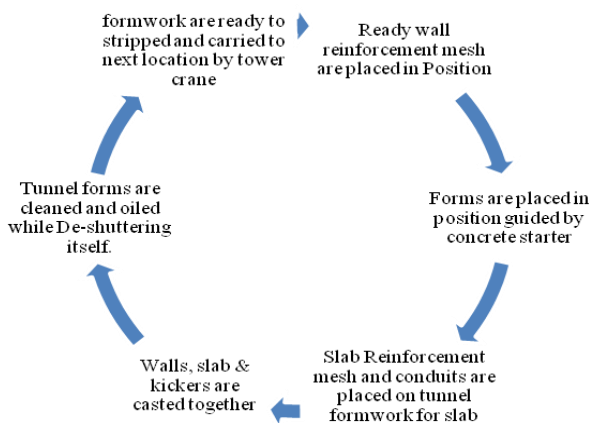
### 3.1 TUNNEL FORMWORK



**TUNNEL FORMWORK**

**Fig - 1: TUNNEL FORMWORK**

A half Tunnel is nothing but a half room sized L-shaped structural steel fabricated form which is used to cast the RCC walls and floor slabs of a building as a monolithic structure in a continuous pour. Two half Tunnel makes one room sized full Tunnel. Sometimes forms are heated using hot air blowers for accelerated curing of the concrete. This system is economical when the structure consists of large number of identical units. To achieve one day slab cycle, the mix design should be designed in such a way that the initial setting time should be higher. Concrete is then poured and the open side of the forms is covered and hot air blowers placed inside. The forms are removed the next day and placed on the next site using cranes. The optimum use of Tunnel form is in multiunit shear wall structure with identical floor layout at each level.



Typical slab cycle of Tunnel formwork

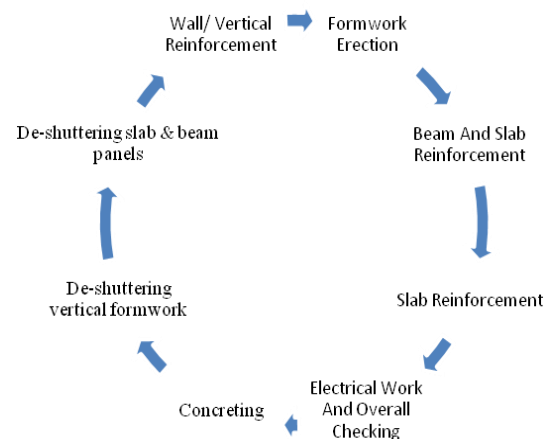
### 3.2 ALUMINIUM FORMWORK



**ALUMINIUM FORM WORK**

**Fig - 2: ALUMINIUM FORMWORK**

As the name indicates the formwork is made of aluminium sheets. Aluminium formwork is lightweight formwork as the weight of aluminium is less compared to steel. This System is fast, simple and cost effective. One can cast all the building elements like walls, slabs columns, beam, staircases etc by using aluminium formwork. Aluminium formwork does not need any heavy or special equipments, all it need is hammer.



Typical slab cycle of Aluminium formwork

Finishing of the aluminium formwork is so good that it eliminates the cost of plastering. Aluminium Formwork allows to cast the walls and slab in same pour

i.e. monolithic construction. These increases efficiency and also produces an extraordinarily strong structure with excellent concrete finish.

Due to the fine tolerance achieved in the machined metal formwork components, consistent concrete shapes and finishes are obtained floor after floor. This allows plumbing and electrical fittings to be prefabricated with the certain knowledge that there will be an exact fit when assembled.

#### 4. CASE STUDY

For this project we took one site where we were able to compare both the formworks i.e. Tunnel formwork and aluminium formwork. The project name is Rohan Abhilasha at wagholi, pune. In this project mainly Tunnel formwork is used but in some parts of a building aluminium formwork is also used. Followings are the details of cases compared :-

##### Case Study 1:-

1. Project Name:- Rohan AbhilashaWagholi, Pune.
2. Project type :- Residential.
3. Formwork Used :- Tunnel formwork.
4. Manufacturer of formwork system:- BUYUK ISKENDER,Turkey.

##### Case Study 2:-

1. Project Name:- Rohan AbhilashaWagholi, Pune.
2. Project type :- Residential.
3. Formwork Used :- Aluminium Formwork
4. Manufacturer of formwork system:- Rohan Builders in-house manufacturing in collaboration with Tejas Enterprises.

#### 5. DATA COLLECTION

Data collected from site is as below:

1. Floor plans, Elevations of building.
2. ERP Schedule ( Highrise Software, MSP)
3. Quantity estimates of material (Steel, Concrete & formwork)
4. Different manuals provided by manufacturers.
5. Actual data collection as per site conditions.

#### Comparison of Tunnel Form and Aluminium Formwork:-

1. Initial cost for tunnel form is very high i.e around Rs.22000/sqm, whereas it is around Rs. 11000/sqm for aluminium formwork.
2. Accuracy is very good in tunnel form construction than aluminium form construction.
3. Generally no plastering required in construction with tunnel form, whereas it is required in aluminium form.
4. Design changes/ design flexibility is very less in tunnel form but it is easily possible in aluminium form.
5. As both technologies need skilled labours, cost of labour is high in both system ( around Rs.200/sqft of slab area). But with proper equipments it can be reduced in tunnel form system.
6. Slab cycle can be actually 1 day in tunnel form, whereas it will be around 10-12 days with aluminium form.
7. As Steel is stronger than aluminium, it can be reused more than 500 times and aluminium shuttering can be used around 150 times.
8. Speed of construction is very high in tunnel form than aluminium form.
9. Equipments/ machineries like Tower crane, hydras etc is more in tunnel form than aluminium form, because heavy tunnels that cannot be shifted without machinery.
10. Skilled staff as well as skilled labours are required in tunnel form system than aluminium form system.

#### 6. DATA ANALYSIS & FINDINGS FROM STUDY

For data analysis detailed study of both the formwork systems is done, also slab cycle time using Tunnel formwork system and Aluminium formwork is compared. Summary of findings after comparing both formwork systems is detailed in comparison above.

## 7. CONCLUSIONS

In India construction industry is known for improper construction, late completion of project, technologically poor, improper management, poor quality of construction. But now a day's lot of research is carried out in this sector, advanced Tunnel formwork & Aluminium formwork system are good examples of this innovation. One can achieve 1 days slab cycle by Tunnel formwork system, where as we can use Aluminium Formwork by which we can achieve slab cycle of 7-10 days. While studying these formwork systems we found that Initial investment for both the formwork system is higher than conventional and operational cost of Tunnel formwork is more than that of Aluminium Formwork. Repetitions of formwork in Tunnel formwork is much more than Aluminium formwork (In Tunnel repetitions are more than 500 and in Aluminium Formwork it is ranging between 150-200). Due to reduction in slab cycle time Tunnel formwork proves more time and cost efficient and economical. Also returns from initial investment regained due rapid completion of project (Completion in 1/3th time than that by Aluminium Formwork system). Hence in long term consideration Tunnel formwork system is beneficial than that of Aluminium Formwork system.

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