

RESEARCH ARTICLE



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COMPARATIVE STUDY OF FORMWORK IN BUILDING CONSTRUCTION

Dr. M.N. BAJAD¹, PAWAN S KHANDELWAL^{2*}, AVIH VYAVAHARE³

^{1,2,3}Civil Engineering Department, Sinhgad College of Engineering, Pune, India



ABSTRACT

Formwork is an open box, like container into which fresh concrete is poured and compacted. When the concrete is set, the formwork is removed and a solid mass is produced in the shape of the inner face of the formwork. Formwork systems are among the key factors determining the success of a construction project in terms of quality, quantity, labor, time and cost. The purpose of this paper is to identify the various factors that influence formwork productivity. When considering a construction project the contractor wants to finish the work quickly with higher profit and the client wants to use the building as soon as possible. To achieve both the most efficient way is to shorten the floor cycle. The type of formwork influence the floor cycle of any high-rise building. The aim of this paper is to study different types of formwork systems in India and to show how each one will affect the project cost, project duration and the quality of the work. The research is done on comparative study of formwork using conventional formwork system and modern-day formwork system.

Keywords-Formwork, quality, cost, duration, labor

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I. INTRODUCTION

Being the second largest urban populated nation in the world, there is an increase in demand for housing in India. Thus leading to popularity of high rise buildings. Aluminium Formwork System saves cost, time and improves the quality of construction. It is successfully used in Japan, Singapore, Malaysia and the Middle East for building apartments, both low and high rises. Aluminium Formwork system is very cost effective for repetition of building layouts and for superstructure. Aluminium Formwork panels can be designed for any component of building such as beams, stairs, columns, balconies, windows and some other

special architectural features. The system is unique as all the components in a building, including staircases, window hood, walls, balconies, beams, slabs, walls and floors are concrete and there is no need for brick works. As all the periphery of resulting structure is concrete and at the same time we can control the concrete quality, the durability of the structure increases. It gives good finish, eliminates the need for external and internal plaster and minimal skim coat can be applied on the walls directly, all these ultimately resulting in cost saving. In comparison to conventional formwork system, aluminium formwork is time saving as the panels are convenient to fix and can be dismantled with ease.

Besides number of labors required for the work is less compared to timber formwork. Formwork is a term given to permanent or temporary matrix or all supporting members in a mold, the whole and sole function of which is to give impression and help concrete till sufficient strength to carry its own weight is achieved. It should be able to bear all live loads and imposed loads apart from its own self weight. From past 3 decades there has been great development in the use of formwork systems for concrete construction. The upheaval till now concentrated on environmental issues, health and safety, on-site production which helped the concrete industry towards better quality of construction and improved efficiency. Different range of formwork systems offers wide solutions to concrete construction which facilitates to meet the requirements of a particular development. Traditional formwork techniques for formwork construction offer tailor made solutions requiring skilled labors. This formwork technique offers slow rate of site construction and indigent safety features and also waste generation is on large scale.

II. OBJECTIVE

- To reduce number of labors used in project work.
- To reduce time required for fixing and dismantling of formwork.
- To optimize cost and time of the project using aluminium formwork.

III. ADVANTAGES OF ALUMINIUM FORMWORK SYSTEMS

- External plaster, internal plaster and brickwork is not required for LIG housing. 5 mm coat of external sand faced plaster is necessary for HIG housing.
- Overhead expenses are less due to speedy construction (4 days per floor).
- Doesn't require timber or plywood for construction activities.
- Slabs and walls can be casted simultaneously.
- Monolithic crack free structures.
- Skilled labors are not required.
- Props are not moved for the removal of

floor slab forms.

IV. DISADVANTAGES OF ALUMINIUM FORMWOK SYSTEMS

- Changes made for architectural sound construction not possible on the structure (but openings can be formed or brickwork wall can be constructed for some parts).
- Financial planning must be foremost part of the project due to high speed construction work of aluminium formwork system.
- Form finish is sufficient condition for LIG housing whereas very good quality of paints is required for HIG housing.

V. CASE STUDY

Sayantara, Ahmednagar is based on conventional formwork construction. Total numbers of flats in Sayantara are 20 and total number of floors are 5. Out of 5 floors, 3 are of 1BHK flats and 2 are of 1RK flats. G+4 storey building is constructed. Total area for 1 floor is 1775 sq feet. 4 flats are constructed on each floor. Formwork design is for 1 floor only. After completion of first floor, same is going to repeat for next floor.

	Quantity	
Area of each floor	1775	Sq ft
Quantity of concrete	85.03	Cu m
Quantity of steel	9131.21	Kg
Plant operation	8	Nos.
Labor for centering	43	Nos.

Table2. Construction with Conventional Techniques

Item	Quantity	Rate	Cost
Concrete M30	85.03 Cu m	4850	4,12,396
Steel	9131.21 Kg	55	5,02,217
Wall	51.33 Cu m	4200	2,15,586
Formwork	3360.68 Sq ft	35	1,17,624
Labor	135 Nos.		44,670
Total			12,92,493

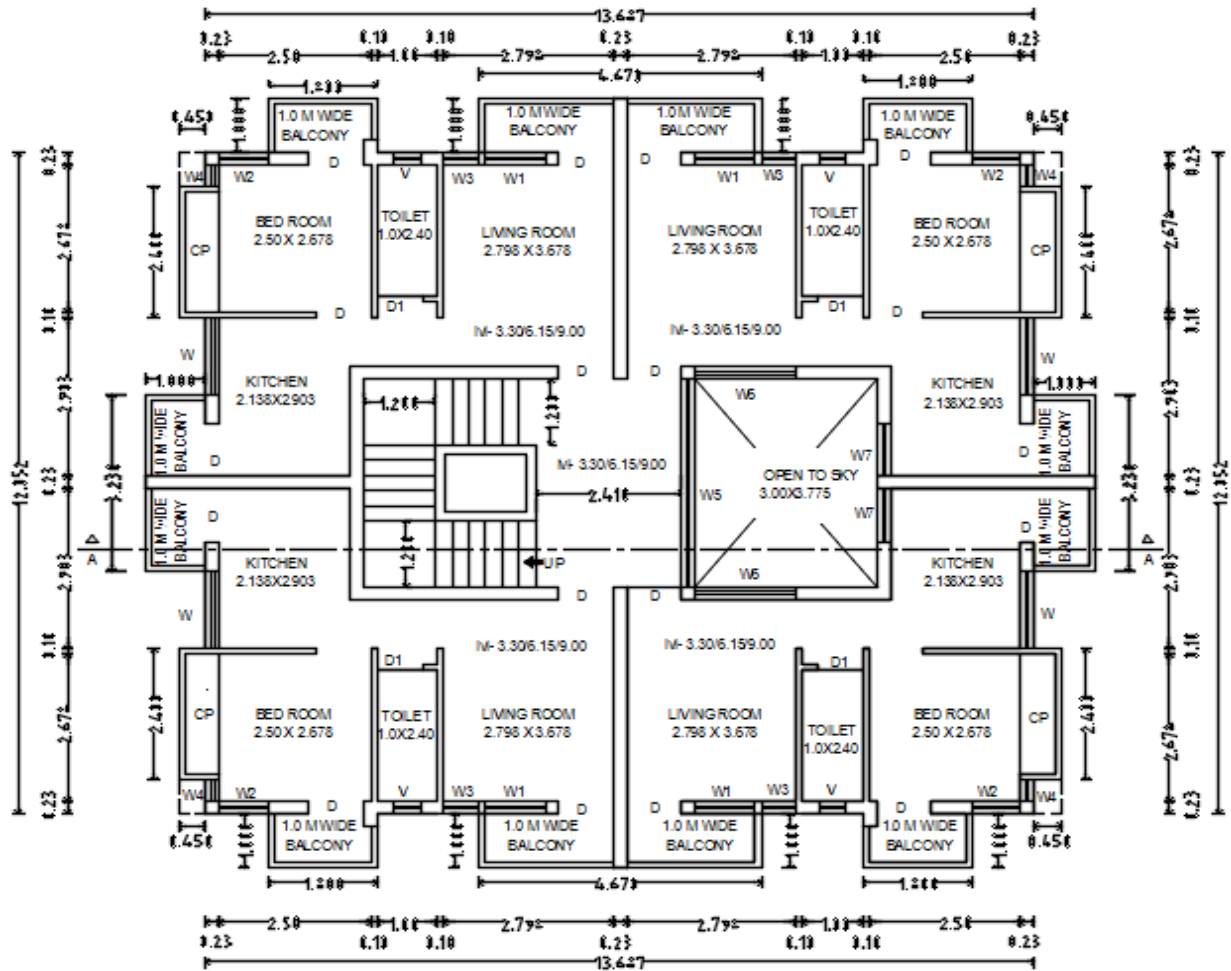


Table 3. Construction with Aluminium Formwork

Item	Quantity	Rate	Cost
Concrete M25	85.03 Cu m	3500	2,97,605
Steel	9131.21 Kg	55	5,02,217
Wall	51.33 Cu m	3500	1,79,655
Formwork	3360.68 Sq ft	4200	1,41,14,856
Labor	105 Nos.		24,900
Total			1,51,19,373

Comparing the digits, number of labor required for aluminium formwork is lesser than that of conventional formwork system. Thus cost of labor is also reduced.

Labor for steel:

Particulars	Quantity	Rate	Per	Amount (rupees)
Labor for steelwork (bending, cranking, binding)	1/Quintal	200	No.	200
Fitter	1/Quintal	150	No.	150
Blacksmith	L.S	50	L.S	50
Beldar				400
T&P				440{400+40}
Total				
*Add 10% contractors profit				

#hence labor rate for steel = Rs.440/Quintal

- Time: For 100 per cent work, construction through slab beam wall construction takes X time

and through Aluminium Formwork technology the time required is 1/6th of the X time. (Enas Fathi Taher, R.K. Pandey, "Study of Delay in Project Planning and Design Stage of Civil Engineering Projects", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-3, February 2013)

- In Aluminium Formwork System the result is a typical 4 to 5 day cycle for floor to floor construction. So the whole G+4 structure can be

structurally constructed in 5 weeks. Whereas Conventional Formwork System it will take 5 months. (Proposed Draft Provisions and Commentary on Indian Seismic Code IS 1893 (Part 1) by Dr. Sudhir K Jain, Dr. C V R Murty.)

- Multi-Storey Housing - structures are completed at the rate of four days per floor regardless of floor size. (<http://www.cse.polyu.edu.hk/>)

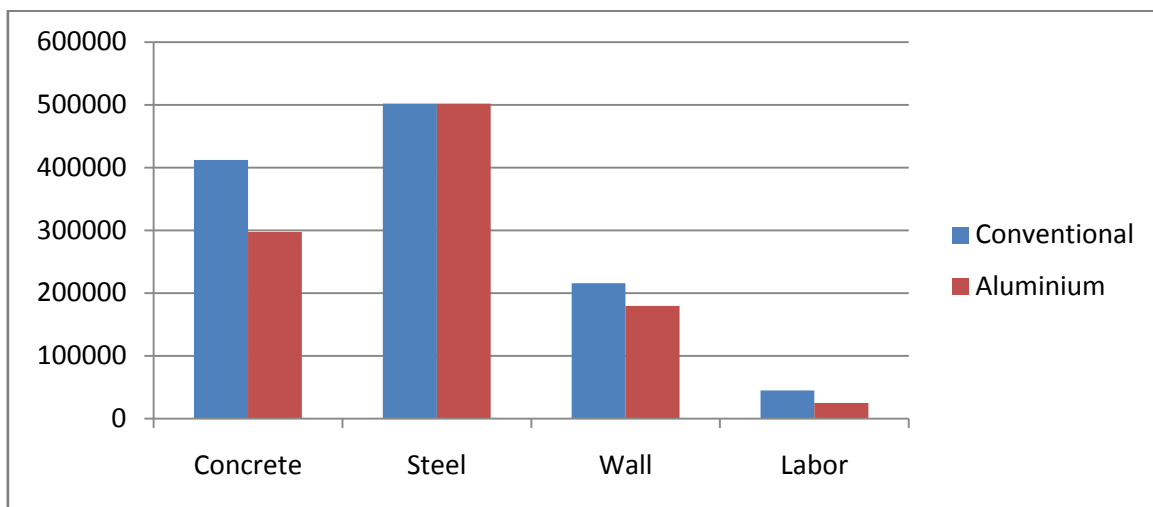


Chart: Comparison of costs with conventional and modern technique

VI. CONCLUSION

- Thus comparing the statistical data of conventional and aluminium formwork, we can conclude that the number of labors required for aluminium formwork is less.
- Hence the labor cost can be optimized.
- Process of shuttering and deshuttering is quick in case of aluminium formwork.
- Therefore, the labor factor and time factor are inter related and directly help to optimize the cost of project.

On the basis of results obtained from the research, we can conclude that the conventional methods of formwork system are economical for small scale projects. Whereas the modern-day methods are economical for high rise mass constructions. The modern methods save cost for construction work and time of construction work. Thus our aim is to maximize the use of modern construction techniques and equipments on its entire project. Aluminium formwork construction technique is cost

effective for the mass construction and repetitive projects. It is rapid construction technique in which construction take place at high speed. Moreover it is offering high quality of construction and low maintenance at the minimum cost. This paper shows the benefits of aluminium formwork over on conventional formwork system. We thus infer that aluminium form construction is able to provide high quality of construction at higher speed and at reasonable cost. Thus it can be concluded that quality and speed must be given due consideration with regards to economy. The construction work should be of good quality as it will never deter to project speed. Also it will be economical.

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