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COMPARITIVE STUDY OF TUNNEL, ALUMINIUM AND CONVENTIONAL FORMWORK FOR MASS HOUSING PROECTS

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Abstract : The design of mass housing is becoming more and more important because it both ensures urban aesthetics, brings uniqueness and meets the increasing needs of users. Therefore, it is necessary to propose alternatives to new design methods for these buildings. The construction industry plays the largest role in the Indian economy. In recent times, if we look at the global economy and population growth in India, land acquisition has become more difficult. To meet the shelter needs of this growing population of and increasing industrialization, the rapid construction of was a necessity of the times. At the same time, due to unsuitable land Vertical growth takes precedence over horizontal growth. Formwork plays an important role in the construction of buildings. It accounts for 20% of the cost and 60% of the total construction time. This project compares conventional formwork , formwork. tunnel mold and aluminum formwork.

IndexTerms **- Mass housing, Conventional Formwork, Tunnel Formwork, Aluminium Formwork, Construction Cost, time.**

I. INTRODUCTION

Today, despite partial changes and innovations in this approach, we find that its negative effects (standardization, repetition, simplification, etc.) different implementations. In addition, concepts such as uniqueness, diversity, and user preferences have been ignored or downplayed. Therefore, it has become important to develop design methods capable of presenting different solutions taking into account user preferences and requirements. Contrary to its effectiveness in other areas, mass customization cannot be fully appreciated in mass housing design for various reasons, from lack of IT support to large number of user types. differences, differences in size and cooperation among stakeholders. However, it has considerable potential in developing these designs in the event that it effectively benefits from developments in technology and computational methods. The mass housing designs that were quietly popular in urban cities have severely affected both urban aesthetics and the collective or individual satisfaction of various user groups. Until recently, these designs were carried out in tandem with modernist mass production techniques, but it cannot be said to have achieved satisfactory results.

Formwork used in construction works accounts for 20-25% of the construction cost, so choosing the most suitable formwork for mass housing will bring success to the project. Formwork can be defined as a temporary structure that is used to support fresh concrete until the concrete has attained its own strength. The selection of formwork for mass housing grade depends on cost, time and quality of finishing. The construction of mass housing involves a variety of repetitive activities. For the repetitive work and construction of high-rise buildings, tunnel formwork system and aluminum formwork system are developed. The mass housing designs that were quietly popular in urban cities have severely affected both urban aesthetics and the collective or individual satisfaction of various user groups. Until recently, these designs were carried out in tandem with modernist mass production techniques, but it cannot be said that satisfactory results have been achieved.

1.1 Conventional Framework System

The most common material used for wall formwork is plywood sheet, where it is used in combination with wood. Typically, wall forms are panels framed with plywood panels joined to a wooden frame. If proper attention is not given to the corners and joints of the slab, grout can flow out in the form of grout, resulting in poor build quality. The cycle time for a floor with the use of conventional forms of is at least 3-4 weeks. In addition, plastering and plastering with block or brick is required to achieve the surface finish. It takes more time and skilled labor too. This ultimately increases the time required to complete the project

1.2 Tunnel Framework System

Tunnel formwork is a chamber formwork in which RCC plate and wall are continuously cast. Then, using streams of hot air, the heat curing process is used to accelerate the concrete. The cycle time for the tunnel formwork system is only 1-3 days, The tunnel formwork system is very useful for the repetitive design of room.

1.3 Aluminium Framework System

Aluminum formwork is also known as MIVAN technology. Forms have large room sizes for the walls and floor slabs to be erected on site. These shapes are strong and sturdy, the is precisely made and easy to hold. They allow a large number of repetitions.

II. RESEARCH METHODOLOGY

For all engineering work, it is necessary to know in advance and the probable construction cost is known as estimated cost. During the preparation of any quote, the quantities of the different work items are calculated using a simple measurement method and from these quantities the costs are calculated. Since tunnel formwork, aluminum formwork technology was applied in this project, the number of construction activities has decreased, thus increasing the number in some operations. For example, the number of activities such as masonry, plastering and painting decreased. While the amount of steel and concrete increased. Before these technologies came into existence, the conventional method (i.e. an estimate for the conventional method and it was compared with cost and quantity while using aluminum, tunnel formwork technology. For conventional methods, we considered the same carpet surface, but instead of a concrete wall, we used a non-load bearing wall with a frame structure.

2.1 Scope of the Study

In this project, we will discuss a step-by-step approach to tunnel formwork and aluminum formwork technology with provisions for speed, quality, and necessary construction aspects. essential to the success of a group housing project, with the help of a case study from a well-known company. The project also includes a comparison of tunnel formwork, aluminum formwork technology and conventional systems. This comparison shows the total cost reduction. Other aspects include its box-like structure, which proves to be very beneficial when it comes to earthquake resistant structures.

2.2 Objective

To compare the conventional, aluminum and tunnel formwork on the basis of

1) Cost Parameter
2) Time parameter,
3) Quality Parameter,
4) Quantity Parameter.

Research relevance Concrete formwork involves the use of supporting structures and forms to create concrete structures that are cast in a mold. There are many types of formworks used in construction, often varying depending on the requirements and challenges of the building. Formwork is used by creating wooden, steel, aluminum or prefabricated molds into which concrete is poured. It is then allowed to harden and harden, after which it is stripped, or in the case of formwork left in place, it is left as part of the structure. Formwork allows contractors to pour and construct relatively quickly key building components that need structural strength and support, such as floors and walls, as well as smaller building components such as stairs.

2.3 Methodology of the Work

The methodology worked out to achieve the above-mentioned objectives is as follows:

1. Review the existing literature of Conventional, Aluminium and Tunnel formwork
2. Select a type of model for the study- Ms. Rohan Builders, Wagholi Pune
3. Costing Comparison of Conventional, Aluminum and Tunnel formwork.
4. Analysis work to be carried out.
5. Interpretation of results and conclusion.

III. DATA ANALYSIS

3.1 Estimation of Quantities for Conventional, Aluminium and Tunnel formwork

For all engineering work, it is necessary to know in advance and the probable construction cost is known as estimated cost. During the preparation of any quote, the quantities of the different work items are calculated using a simple measurement method and from these quantities the costs are calculated. Since the formwork of the tunnel, Mivan technology was applied in this project, the number of construction activities has been reduced, thus increasing the number in some operations. For example, the number of activities such as masonry, plastering and painting decreased. While the amount of steel and concrete increased. Before the advent of Mivan Technology tunnel formwork, conventional methods (i.e. frame structures with load-bearing walls) were suitable for high-rise buildings, even if they were modular structures. Therefore, in order to know the difference in cost and feasibility of the project, we make an estimate according to the conventional method and compare it with the cost and volume when using Tunnel and Mivan technology. In the conventional method, we considered the same carpet surface, but instead of a concrete wall, we took a non-load-bearing wall with a frame structure.

3.2 Costing and Quantities per floor area

Table 1: Conventional framework quantities and costing per floor area.

Sr.No.	Quantity	Description	Rate	Unit	Amount
1	58.942	M40 Grade Concrete-Slab	6000	Cu.Mtr.	353652
2	4.472	M40 Grade Concrete-Staircase	6000	Cu.Mtr.	26832
3	32.942	M40 Grade Concrete- Columns	6000	Cu.Mtr.	197652
4	38.194	M40 Grade Concrete -beams	6000	Cu.Mtr.	229164
5	407	Timber Shuttering and centering per floor	1076.391505	SQ.M per floor area	438091.3426
6	407	Labour cost incurred for centring and shuttering	1076	SQ.M per floor area	437932
7	6.14	Reinforcement cost including rebar bending cutting laying	94800	MT	582072
9	423	External Brickwork	1536	SQ.M per floor area	649728
10	423	External Plaster	972	SQ.M per floor area	411156
					3326279.343

Table 2: Aluminium framework quantities and costing per floor area.

Sr.No.	Quantity	Description	Rate	Unit	Amount
1	59.73	M40 Grade Concrete in walls	6000	Cu.Mtr.	268772
2	58.942	M40 Grade Concrete-Slab	6000	Cu.Mtr.	102015
3	4.472	M40 Grade Concrete-Staircase	6000	Cu.Mtr.	7722
4	32.942	M40 Grade Concrete- Columns	6000	Cu.Mtr.	57024
5	38.194	M40 Grade Concrete -beams	6000	Cu.Mtr.	66105
6	407	Aluminium formwork	64583.49031	SQ.M per floor area	26285480.55
7	407	Labour cost incurred for centring and shuttering	2690.978763	SQ.M per floor area	1095228.356
8	8.95	Reinforcement cost including rebar bending cutting laying	94800	MT	848460
					28730806.91

Table 3: Aluminium framework quantities and costing per floor area.

Sr.No.	Quantity	Description	Rate	Unit	Amount
1	59.73	M40 Grade Concrete in walls	6000	Cu.Mtr.	268772
2	58.942	M40 Grade Concrete-Slab	6000	Cu.Mtr.	102015
3	4.472	M40 Grade Concrete-Staircase	6000	Cu.Mtr.	7722
4	32.942	M40 Grade Concrete- Columns	6000	Cu.Mtr.	57024
5	38.194	M40 Grade Concrete -beams	6000	Cu.Mtr.	66105
6	407	Tunnel formwork per floor	107639.1505	SQ.M per floor area	43809134.26
7	407	Labour cost incurred for formwork	3229.174515	SQ.M per floor area	1314274.028
8	8.95	Reinforcement cost including rebar bending cutting laying	94800	MT	848460
					46473506.29

3.3 Costing Analysis per Repetition for Conventional, Aluminum and Tunnel formwork

Table 4: Costing Analysis per Repetition for Conventional, Aluminum and Tunnel formwork

No.of Repetitions	Cost with Conventional formwork	Cost with Aluminium formwork	Cost with Tunnel formwork
1	3326279.343	2,87,30,807	46473506.29
10	29758062.34	5,07,38,740.9114453	70452854.29
20	59078033.34	7,51,92,000.9114453	97096574.29
30	87959913.34	9,96,45,260.9114453	123740294.3
40	117717975.3	12,40,98,520.9114450	150384014.3
50	146599855.3	14,85,51,780.9114450	177027734.3
60	175919826.3	17,30,05,040.9114450	203671454.3
70	205239797.3	19,74,58,300.9114450	230315174.3
80	234559768.3	24,81,97,041.4664330	256958894.3
90	263879739.3	27,26,50,301.4664330	283602614.3
100	292761619.3	29,71,03,561.4664330	310246334.3
110	322081590.3	32,15,56,821.4664330	336890054.3
121	354289749.3	34,84,55,407.4664330	366198146.3
131	383609720.3	37,29,08,667.4664330	392841866.3
140	410041503.3	39,49,16,601.4664330	416821214.3
141	412929691.3	39,73,61,927.4664330	419485586.3
142	415817879.3	39,98,07,253.4664330	422149958.3
150	438923383.3	41,93,69,861.4664330	443464934.3
160	468681445.3	47,01,08,602.4664330	470108654.3
170	497563325.3	49,45,61,862.4664330	496752374.3
180	526883296.3	51,90,15,122.4664330	523396094.3
190	556203267.3	54,34,68,382.4664330	550039814.3
200	585523238.3	56,79,21,642.4664330	576683534.3
219	640836901.3	61,43,82,836.4664330	627306602.3
220	643725089.3	61,68,28,162.4664330	629970974.3
230	673045060.3	66,75,66,903.4664330	656614694.3
240	702365031.3	69,20,20,163.4664330	683258414.3
250	731685002.3	71,64,73,423.4664330	709902134.3
260	761004973.3	74,09,26,683.4664330	736545854.3
270	789886853.3	76,53,79,943.4664330	763189574.3
280	819644915.3	78,98,33,203.4664330	789833294.3
290	848526795.3	81,42,86,463.4664330	816477014.3
300	877846766.3	83,87,39,723.4664330	843120734.3
310	907166737.3	88,94,78,464.4664330	869764454.3
320	936486708.3	91,39,31,724.4664330	896408174.3
340	994688559.3	96,28,38,244.4664330	949695614.3
350	1024008530	98,72,91,504.4664330	976339334.3
361	1056216689	1,01,41,90,090.4664300	1005647426
370	1082648472	1,03,61,98,024.4664300	1029626774
380	1111968443	1,08,69,36,765.4664300	1056270494
390	1140850323	1,11,13,90,025.4664300	1082914214
400	1170608385	1,13,58,43,285.4664300	1109557934
410	1199490265	1,16,02,96,545.4664300	1136201654
420	1228810236	1,18,47,49,805.4664300	1162845374
430	1258130207	1,20,92,03,065.4664300	1189489094
440	1287450178	1,23,36,56,325.4664300	1216132814
450	1316770149	1,25,81,09,585.4664300	1242776534

3.3 Duration in days Analysis per Repetition for Conventional, Aluminum and Tunnel formwork

Table 4: Comparison of Duration in days Analysis per Repetition

No.of Repetitions	Duration in Days- Conventional formwork	Duration in Days- Aluminium formwork	Duration in days-Tunnel formwork
1	14	45	60
50	700	395	160
100	1400	745	260
150	210000	1095	360
200	280000	1445	460
250	70000000	1795	560
300	84000000	2145	660
350	29400000000	2495	760
400	33600000000	2845	860

IV. RESULTS

4.1 Results

1. Comparing construction costs by two methods, it can be concluded that tunnel formwork technology is an economic method for collective housing projects.
2. From the cost comparison, the tunnel formwork helps to reduce the total project cost by 12.12%.
3. Applying Mivan technology in the project, not only reduces the cost but also increases the construction speed., since some build operations are eliminated entirely and others are reduced to some extent.

V. CONCLUSION

Time plays a major role in the cost of any project and is heavily influenced by the type of system applied. Case study will be helpful for the selection of formwork to be used in the upcoming future. This will also be helpful in minimizing construction waste due to formwork.

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