A Comparative Study of Table Formwork & AluDeck Formwork for Commercial Project

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***Abstract*—Formwork plays important role in the speed and quality of the construction. It is an essential part of the structure. Formworks for any project are built in accordance with the design and drawing of the project. Since the framework represents between 25% and 30% of the total building expenditures, it is imperative that every project select a suitable one. Such a huge share of cost is dependent on the formwork system. The current study primarily examined table and AluDeck formworks systems in a project and compared their costs and timelines based on resource estimation. Case studies were considered for the study having 1000sq.m shuttering area and 100 repetitions. The comparison is done on the basis of time and cost. The analysis has shown; table formwork is more suitable compare to AluDeck when building is of commercial type. The outcome demonstrates that AluDeck is appropriate for skyscrapers and table formwork is better suited for high-rise structures.**

***Index Terms*— AluDeck, Formworks, shuttering, Construction.**

I. INTRODUCTION

Commercial projects in civil engineering involve the construction of structures primarily used for business, retail, hospitality, healthcare, and services. Examples include office buildings, malls, hospitals, hotels, airports, and education centers. It includes Large-scale, multi-story construction, Tight schedules requiring efficient systems like AluDeck and Table Formwork. It has High load-bearing and utility requirements (MEP, HVAC, elevators). They mainly focus on sustainability, fire safety, and accessibility(Allam et al., 2023)

Fresh concrete is poured and compacted into formwork, which resembles a mold. A solid mass in the shape of the formwork's inner face is obtained when the formwork is removed once the concrete has set. Formwork plays a major role in the development of concrete elements' strength and geometry. Smaller components of the building, such staircases, are also cast using the same formwork that is used to cast structural elements like columns, beams, and slabs(Daukšys, 2016).

The building's formwork is an essential undertaking that requires extraordinary skill and accuracy. Inaccuracy and incompetence in formwork construction can lead to incomplete and subpar work, which eventually costs valuable resources like time and money. The process of removal of formworks is known as stripping. A good formwork should be able to withstand the forces being applied to it either during or after the concreting process. When the concrete has hardened and matured, the formwork is carefully removed. The formworks are free of slurry leaks. After stripping, a good formwork should have a smooth, wrinkle-free surface, which will result in a higher-quality concrete product that is smoother. It ought to be strong enough to withstand repeated use. Overloading any props, excessive vibrations from needle surface vibrators, poor supervision, poor shuttering design and planning, and centering and concreting activities are the main reasons why formworks fail(Dewangga, 2024). New materials have always been embraced by the construction industry. In the past, mud mortar was used to join building blocks, but cement has recently taken over the construction business due to its demands. We offer around thirty different types of cement(Handayani and Umam, 2020). In the same way that cement is one of the main building materials, formwork is also a significant concern. In the past, we used soft wood and wooden boards as the formwork materials; however, these days, we employ steel, PVC, and aluminum frames(Devi and Yadav, 2023).Today's faster construction and higher-quality finishes are made possible by new formwork materials, which is why there is a demand for new materials. In addition to producing a high-quality final product, modern formwork does it in a remarkably short amount of time(Shrivastava, Chourasia and Saxena, 2020).

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II. NEED OF STUDY

Steel, wood, plywood, aluminum, composite materials, and other materials are utilized to construct the formworks. Large floor slabs and horizontal surfaces are the primary applications for table formwork, a reusable formwork system that comes pre-assembled. Beams, decking panels, props, and wheels for effortless mobility make up its framework. Because it expedites construction, lowers labor expenses, and provides a smooth, level surface, table formwork is often used. It is perfect for projects with repeating floor patterns, such as high-rise structures, because it can be swiftly moved without requiring disassembly. However, because of its size and weight, it needs cranes or other lifting equipment, and it costs more to start with than standard formwork(Kwon et al., 2013). Large floor slabs and horizontal surfaces are the primary applications for the lightweight, modular AluDeck formwork system composed of aluminum panels. It is made up of connectors, props, decking panels, and aluminum frames. Because it is lightweight, strong, easy to handle without cranes, and quick to assemble and disassemble, AluDeck is the material of choice. It can be used repeatedly and offers a consistent, smooth concrete surface. The initial cost is higher than for typical formwork, though, and because aluminium is softer, care must be given to prevent damage from rough handling. Different formwork styles, including Table and AluDeck, were examined in this study, and time and cost comparisons were performed.

The current study examined various formwork styles, including Table and AluDeck, and compared their costs and duration. It is made up of connectors, props, decking panels, and aluminium frames. Because it is lightweight, strong, easy to handle without cranes, and quick to assemble and disassemble, AluDeck is the material of choice. It can be used repeatedly and offers a consistent, smooth concrete surface. The initial cost is higher than for typical formwork, though, and because aluminium is softer, care must be given to prevent damage from rough handling. Different formwork styles, including Table and AluDeck, were examined in this study, and time and cost comparisons were performed.

III. LITERATURE

A. Formwork system

Due to the demands of the building sector, the world is now using the best materials available, which can cut down on project time and expense. In addition to being sustainable, the materials used today should be aesthetically pleasing, long-lasting, and able to be tailored to the needs of the customer. It will be favored and in higher demand if it has all of the aforementioned attributes. These days, the building industry uses a variety of formwork materials and techniques to expedite construction. Building type will determine the formwork materials utilized, whether the building is commercial, residential, industrial, or another kind of structure. The selection of kind of formwork is in it itself is big task and it effects the overall cost of the project(Devi and Yadav, 2023). The Mivan or aluminum formwork was contrasted with the traditional form-work. In comparison to traditional formwork, the results demonstrated that the Mivan formwork produced an extremely high-quality finish without the need for plastering. Steel and aluminum formwork are reasonably comparable. Naturally, the majority of it is composed of aluminum. The main difference between formwork made of steel and aluminum is that the former is lighter than the latter. This is because aluminum is simpler to handle than steel because it has a lower density (Jangid et al., 2023).

(Terzioglu, Polat and Turkoglu, 2021) carried out an analysis that addresses the criteria that must be applied in order to choose the formwork, but it offers no information about the cost of selecting the formwork or the number of components. An examination of formwork material planning was carried out by Srivastava, who found that the type of building—commercial, residential, industrial, or industrial—will determine the formwork materials that are chosen. Choosing the type of formwork is a significant undertaking in and of itself, and it has an

impact on the project's total cost. It is one of the main factors that also influences the building's architecture (Terzioglu, Polat and Turkoglu, 2021).

B. Table formwork system

Table formwork, also known as flying formwork or table forms, is a type of formwork system used for large floor slabs in multi-story buildings. It consists of large prefabricated, reusable formwork tables that can be quickly moved from one floor to the next, speeding up construction (Koo et al., 1994). Concrete slabs are supported by table formwork while they are being poured and allowed to cure. It usually comprises of a table-like framework with vertical and horizontal supports that the concrete is poured over. For big, recurring floor structures, this formwork technique works well because it gives workers and equipment a firm platform. A supported and appropriately formed slab is left behind after the formwork is removed once the concrete has set (Bhilwade et al., 2023).

Fig-1 Image representation of a table type of formwork system

C. AluDeck formwork

The AluDeck formwork system is an aluminum-based modular formwork primarily used for slab construction. Its lightweight design and simplicity make it popular for large-scale construction projects. AluDeck formwork represents a modern approach to construction, particularly in high-rise and affordable housing projects. This aluminum formwork system is recognized for its efficiency, sustainability, and ability to enhance construction quality. The combination of Building Information Modelling (BIM) with AluDeck formwork enhances design precision and project management, leading to improved construction outcomes.

While AluDeck formwork offers numerous benefits, challenges such as the need for specialized training and higher upfront costs may deter some contractors from its adoption. However, the long-term advantages often outweigh these initial hurdles, positioning AluDeck as a forward- thinking solution in the construction industry(Youfeng Xiao, 2021).

Fig-2 Image representation of a AluDeck type of formwork system

IV. METHODOLOGY

In the present study, two case studies were considered, Vantage Tower, Wagholi, Pune having built up area of 26 Lakhs Sq. ft and LODHA Giardino MLCP, Wagholi, Pune, having built up area of 7.52 Lakh Sq.m. The first project has used table formwork system for shuttering and AluDeck formwork system for second project. Both the projects were handled by Millennium Engineers and Contractors Pvt. Ltd. Pune. The area of the floor was calculated first. Considering the total shuttering area of 1000 Sq.m for both case studies for which the formwork is required. After knowing the area from the plan manually, the total material required to cover the slab area is calculated. Calculation of slab cycle was done and repetition was considered 100 times for both cases. Then based on the calculation the total number of props, channels and other components used to support the concrete for the construction of these elements on the building. All the calculations were done manually. After knowing the quantity of the components that is required, the respective prices and the cost of each component are researched as per the local market. In addition to the formwork it also involves the cost and analysis of the components of the scaffolding required for the construction. For the Table and AluDeck formwork the rate list is collected based on the components that are used in the analysis. For the components used in the scaffolding the rates are collected from the local vendor and then calculated the total cost of the scaffolding is based on the components used. Following are the steps.

i. Calculation of area of plan
ii. Calculation of formwork requirement
iii. Rate & time analysis of selected formwork
iv. Comparison

V. RESOURCE ESTIMATION

A. Materials requirement

The different formwork systems, Table and AluDeck formworks were used in a project and a cost comparison was carried out. Calculation of aluminum formwork was done on a square meter basis. The different assets were used in Table and AluDeck formwork have been given in Tables respectively

Table 1-Assets required for Table formwork

Material Req. For 1 Table Size = 3.25x5.5 = 17.875 Material Req. For 56			
Material	Nos.	Material	Nos.
Primary K6	4	Primary K6	224
Secondary K6	18	Secondary K6	1008
V Clamps	72	V Clamps	4032
Table Head	8	Table Head	448
Props	8	Props	448
Tripod Stand	4	Tripod Stand	224
Ply	6	Ply	336
Counter Sunk Screw	210	Counter Sunk Screw	11760
MYK Shuttering Oil	1 lit.	MYK Shuttering Oil	56

Basically the table formwork includes the Primary K6, Secondary K6, V Clamps, Table Head, Props, Tripod Stand, Ply, Counter Sunk Screw. Table -1 describes the quantity of material required for 1000 Sq.m shuttering area. Total number of tables required are 56. MYK Shuttering Oil is used. The material requirement for 56 tables is 224 Primary K6, 1008 Secondary K6, 4032 V Clamps, 448 Table Head, 448 Props, 224 Tripod Stand, 336 Ply, 11760 Counter Sunk Screw and 56 liters of MYK shuttering oil.

Table 2 -Assets required for Aludeck formwork

Panel (Gala) Size in Sq.m	Shuttering Area in Sq.m	No. Of Panels
1.95x1.8=3.51	1000	284
Materials	Material Req. For 1 Panel (Gala)	Material Req. For 284 Panel (Gala)
Meva Panel	3	852
Primary Beam	2	568
Drop Head	4	1136
Props	4	1136
Tripod Stand	4	1136

The size of one panel in AluDeck formwork is 3.51 Sq.m. Total 284 panels will be required for 1000 Sq.m area. Material required for 284 AluDeck formwork will be 852 Meva Panels, 568 Primary Beams,1136 Drop Heads, 1136 Props & Tripod Stands.

B. Manpower requirement

Total number of Labours required for table formwork for 1000 Sq.m will be 11 carpenter and 11 helpers. For 1 table 2 carpenters and 2 helpers are required and the area covered by 1 carpenter and helper is 7 Sq.m.

Table 3 –Labour requirement for Table & AluDeck formwork

TABLE FORMWORK	ALUDECK FORMWORK
Labour Req. 1 Table	Labour Req. 1 Panel (Gala)
2 Cap. + 2 Helper	1 Cap. + 1 Helper
1 CARP. + HELPER	1 CARP. + HELPER
1 DAY = 7 SQ.M.	1 DAY = 4 SQ.M.
FOR 1000 SQ.M. =	FOR 1000 SQ.M. =
11 CARP. + 11 HEPLER	11 CARP. + 11 HEPLER

Total number of Labours required for AluDeck formwork for 1000 Sq.m will be 11 carpenter and 11 helpers. For 1 Panel 1 carpenter and 1 helper is required and the area covered by 1 carpenter and helper is 4 Sq.m.

The work done or area covered in AluDeck formwork is less as compare to the table formwork. To cover 1000 Sq.m shuttering area in table formwork it will take 143 days and in case of AluDeck it will take 250 days for 1 carpenter and 1 helper. When we will provide 11 carpenter and 11 helpers table formwork will take 13 days and AluDeck will take 22 days to complete.

C. Time requirement

The slab cycle (also known as the floor cycle or formwork cycle) refers to the total time required to complete the construction of a single floor slab, from formwork erection to slab casting and curing, including formwork striking and reuse. It is a key performance metric in any high-rise or commercial project, especially when comparing formwork systems like AluDeck and Table Formwork. Slab cycle is important because it directly impacts project schedule, influences labour and equipment costs, affects productivity metrics, helps in project planning (cash flow, procurement, etc.).

Slab cycle of table formwork includes the steps Column/SW Starters, Column/SW Shuttering, Casting, Stressing, Table Shifting, Slab Shuttering Work, Bottom Reinforcement, PT Work, Top Reinforcement, Side Shuttering Work, Slab Casting completed in 2, 2, 1, 1, 4, 4,2, 2,2,1 days respectively. It takes 17 days to complete a typical slab cycle of table formwork.

Slab cycle of AluDeck formwork includes the steps Column Starters, Column Reinforcement, Column Shuttering & Casting, Column De-shuttering, Slab Shuttering, Slab Reinforcement, Slab Casting completed in 2, 5, 4, 2, 10, 4, 1 days respectively.

To complete the total slab work through AluDeck it takes 22 days. It takes 17 days to complete a typical slab cycle of table formwork.

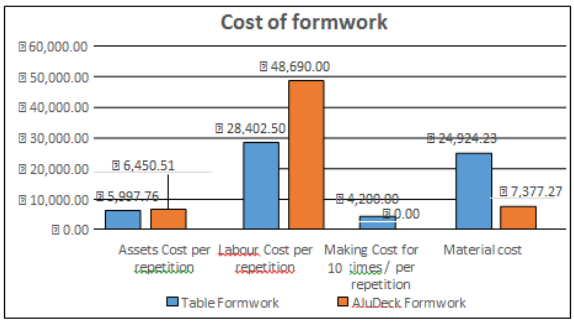

Fig. 4. cost and time comparison of Table and AluDeck type of formwork systems

Fig-4 shows the visual representation of cost comparison of AluDeck and table formwork. Assets cost, labour cost, making cost, material cost. Assets cost is considered under the category of investment cost and it is 5997.76Rs. for table formwork and 6450.51Rs. for AluDeck formwork. Labour cost, material cost and making cost is considered under the category of running cost. Calculation shows that the total average cost per Sq.m per repetition is 6153.05 in case of table formwork and for AluDeck formwork it is 6251.78Rs.

VI. CONCLUSION

The discussion is based on field data collected from slab casting cycles, labour requirements, and material usage, focusing on time efficiency and cost implications. Considering the investment cost, i.e. Assets Cost per repetition, Table formwork system is affordable as compare to the AluDeck formwork system while considering Running cost, AluDeck is more affordable than Table formwork. The difference total average cost per Sq.m per repetition is only 98.73Rs. for 1000Sq.m area and 100 repetitions. More the area more will be the difference. If we consider 1,00,000 Sq.m area, cost of Table formwork will be Rs. 61,53,05,000 (1,00,000 x 6153.05). In case of AluDeck formwork it will be Rs. 62,51,75, 000. Table reduces the cost by apprx. 1.6 % compared to AluDeck Formwork. Also Table reduces the slab cycle time by 23% compared to AluDeck Formwork. Labour requirement for both the formworks is same. The study concludes, Table formwork is more suitable for commercial projects than AluDeck. Also the table formwork is more suitable for high rise buildings and AluDeck is suitable for Skyscrapers.

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