Assessing the impact of conventional formwork and Mivan formwork on construction productivity and efficiency

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Abstract

The construction sector is continuously exploring innovative strategies to enhance productivity and efficiency. This research project centers on evaluating the use of conventional formwork and Mivan formwork in construction projects, aiming to improve construction productivity and efficiency. The primary objective is to compare the time and cost requirements of these two formwork systems to assess their impact on project outcomes. The study employs a mixed-methods approach, combining quantitative and qualitative analyses. A comprehensive review of existing literature is undertaken to gather knowledge on conventional formwork, Mivan formwork, construction productivity, and efficiency. Data is collected from construction projects that have employed both formwork systems, and key performance indicators such as project duration, labor productivity, material consumption, and costs are examined and compared. The findings will provide valuable insights into the advantages and limitations of conventional formwork and Mivan formwork. The analysis will identify the factors that influence productivity and efficiency in each system and highlight areas for potential improvement. The ultimate aim of this study is to provide guidance to construction professionals in making informed decisions regarding the selection of formwork systems, taking into account factors such as cost, time, labor requirements, and quality. Additionally, the research will contribute to the existing knowledge base on construction productivity and efficiency, offering recommendations to enhance project outcomes. By identifying the strengths and weaknesses of conventional formwork and Mivan formwork, this study seeks to drive advancements in construction practices and contribute to overall industry improvement.

Keywords: Mivan formwork; Specialized training; Quality control; Comparative analysis; Reusability; Project schedule

1. Introduction

In the construction industry, the traditional method of constructing concrete structures using conventional formwork has been practiced for decades. Conventional formwork involves the use of wooden frames and plywood sheets to create temporary structures or molds for pouring concrete. This method has stood the test of time and remains popular due to its versatility and ability to handle complex shapes and designs. Choosing the right formwork method is a crucial decision that significantly impacts various aspects of a construction project, including cost, timeline, and quality. The selection of an appropriate formwork system can optimize efficiency, productivity, and ultimately contribute to the success of the project. This study aims to assess the effectiveness and performance of conventional formwork in construction projects, with a focus on enhancing construction productivity and efficiency. By comparing the duration and cost of conventional formwork projects, valuable insights can be gained to improve project outcomes. Furthermore, this research will explore the factors influencing productivity and efficiency in conventional formwork, identifying areas
where improvements can be made. The findings of this study will provide construction industry professionals with valuable guidance for making informed decisions regarding formwork selection, considering factors such as cost, time, labor requirements, and quality. The ultimate goal of this research is to contribute to the existing knowledge base on construction productivity and efficiency, driving advancements in construction practices and supporting the overall improvement of the construction industry.

2. Literature Review


Objectives

1. To determine the optimal formwork system for building construction, by thorough assessment of factors.
   - Duration
   - Cost
   - Quality
2. Evaluate the cost-effectiveness of conventional formwork and mivan formwork in construction projects.
3. Recommendations for improving construction productivity.

3. Methodology
3.1. Erection of Aluminum formwork

![Figure 1 Erection of wall panel](image1)

![Figure 2 Fixing of wall panel](image2)

![Figure 3 Slab decking](image3)

![Figure 4 Fixing of deck panel](image4)

![Figure 5 Removing wall tie](image5)

3.2. Erection of Conventional formwork

- Fixing of formwork Panels
- Fixing of Beam bottom
- Slab decking
- Supporting

![Figure 6 Timber Plywood](image6)

![Figure 7 Waler Beam](image7)
3.3. Experimental Study

Sheet 01 Excel Sheet for shuttering quantity

3.3.1. Shuttering area Calculation for A wing (Conventional Shuttering) Total

Total no of floor: 13no’s = 13 X 1806 = 23,478 sqm shuttering area. (For A wing)

Figure 8 Conventional Shuttering Conventional

Material Requirement Cost & Labor Cost Material Cost Per SQM: 159 Rupees

Total Approx material cost of conventional: 37,28,410 Rupee

3.3.2. Labor Cost

Labour cost for Formwork Making, shifting, lifting to any lead & lift, erection, support, for Column, beam & Slab conventional formwork area :1009 rupees per Sqm

Total Labour Cost: 1,99,56,300 Rupees
3.3.3. Total Cost

Material And Labour Cost Per SQM: Rupees Total Area: 23,478 Square meter = 23,478 X 908

Total Cost for Conventional shuttering work of A wing: 2,36,89,302 Rupees

3.3.4. Aluminum Material Requirement Cost& Labor Cost

![Figure 9 Conventional Shuttering](image)

Shuttering area Calculation for B wing (Mivan shuttering)

Total Shuttering Quantity of slab and beam per floor: 845.084 Square meter.

Total Shuttering quantity considering Column, Slab & Beam for 1 floor: 1806 sqm Total no of floor: 13no's = 13 X 1806 = 23,478 sqm shuttering area. (For B wing) Material Cost

Total Shuttering quantity considering Column, Slab & Beam for 1 floor: 1806 sqm. Material Rate Per Sqm for aluminum shuttering: 7000 Rupees

Total area: 1806 X 7000

Total Material Cost for aluminum shuttering: 1,26,42,000 Rupees.

Labor Cost

Labour cost for Formwork Making, shifting, lifting to any lead & lift, erection, support, for Column, beam & Slab conventional formwork area:350 rupees per Sqm

Total Labour Cost: 83,46,800 Rupees

Total Cost


Total Material Cost for aluminum shuttering: 1,26,42,000 Rupees. Total Cost aluminum shuttering work of B wing: 2,09,88,800 Ru
Disadvantages of using Mivan Formwork

- Initial Investment: Mivan formwork, in particular, often requires a higher initial investment compared to conventional formwork systems. The specialized components and equipment associated with Mivan formwork can result in higher upfront costs, which may pose a challenge for projects with limited budgets.
- Training and Skilled Labor: Mivan formwork, due to its specialized nature, may require skilled labor and proper training for its effective implementation. The need for trained workers proficient in Mivan formwork techniques can increase labor costs and may pose challenges in regions with a shortage of skilled workers.
- Design Flexibility: Conventional formwork offers more flexibility in terms of shaping and accommodating complex designs and architectural requirements. Mivan formwork, with its standardized components and assembly process, may have limitations in achieving intricate shapes or unique architectural features.
• Adaptability to Changes: Conventional formwork can be easily modified or adjusted to accommodate design changes or on-site alterations during construction. Mivan formwork, on the other hand, may require more planning and coordination to incorporate changes, as it follows a systematic assembly process.

• Suitability for Small-Scale Projects: Mivan formwork is often more suitable for large-scale construction projects where the benefits of speed and efficiency can be maximized. For smaller projects with limited resources or shorter durations, the higher upfront investment and specialized nature of Mivan formwork may not be justified.

• Reusability and Disposal: While both conventional formwork and Mivan formwork have the potential for reusability, Mivan formwork may require more careful handling and storage to ensure its longevity. Improper handling or lack of suitable storage facilities can reduce the reusability of Mivan formwork components. Additionally, the disposal of formwork materials, particularly plywood in conventional formwork, must be managed properly to minimize environmental impact.

Table 1 Time Analysis

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Conventional</th>
<th>Mivan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Days</td>
<td>364</td>
<td>156</td>
</tr>
<tr>
<td>Material Cost</td>
<td>Rupees</td>
<td>37,28,410</td>
<td>1,26,42,000</td>
</tr>
<tr>
<td>Labour Cost</td>
<td>Rupees</td>
<td>1,99,56,300</td>
<td>83,46,800</td>
</tr>
</tbody>
</table>

Graph 02 Comparison of Days

4. Conclusions

• Mivan formwork demonstrates significant benefits in terms of time savings, cost efficiency, improved quality, enhanced safety, increased productivity, and sustainability. Its systematic assembly process and use of pre-fabricated components contribute to faster construction, reduced labor requirements, and higher quality finishes. However, Mivan formwork may require a higher initial investment and skilled labor, and it may have limitations in design flexibility and adaptability to changes.

• Conventional formwork, on the other hand, remains popular due to its versatility and ability to handle complex shapes and designs. It offers cost advantages, particularly when using readily available materials. Conventional formwork allows for greater design flexibility and easier adaptability to on-site changes. However, it may require more labor and time, and the disposal of formwork materials must be managed properly.

• To enhance construction productivity and efficiency, a comprehensive assessment of the specific project requirements, budget constraints, available skilled labor, and desired architectural features is crucial. By considering these factors, construction industry professionals can make informed decisions about selecting the most suitable formwork system for their projects.
Future research in this area should focus on further exploring the comparative analysis of conventional formwork and Mivan formwork, investigating their long-term cost-effectiveness, addressing any limitations of the formwork systems, and identifying strategies to overcome the challenges associated with their implementation. Overall, the assessment of formwork systems plays a vital role in optimizing construction productivity and efficiency, leading to successful project outcomes.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest.

References


