

Time And Cost Efficiency Of Conventional Formwork In Building Projects

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ABSTRACT

In the implementation of the construction of multi-storey buildings, formwork work requires large costs and a long time. Therefore, it is necessary to use a more effective method both in terms of cost and implementation time. Along with the development of technology in the world of construction, there are many formworks that are applied in the field in the structure of project development. In this study, the objectives to be achieved are to analyze costs and time according to the implementation method of formwork work. This study uses a quantitative research method, where the data used includes the unit price of work, volume of work, and the budget plan for the ongoing project. The results of the study show that the estimate of conventional formwork work requires a cost of Rp. 44,360,000,000.00 with a processing time of 59 days.

Keywords: Building Construction, Conventional Formwork, Cost, Time

1. INTRODUCTION

In infrastructure development, time efficiency and cost are two crucial aspects that are often the main focus in construction projects. The construction project of the V Joint Lecture Building at the University of Muhammadiyah Malang is one example where the use of the right formwork can have a significant impact on both aspects. Skirting, as a temporary mold for concrete, plays an important role in determining the speed and quality of construction work. Therefore, the selection of formwork applied to the project is urgently needed to analyze its effect on construction costs and time (Yogiswara, Andreas, & Trisno Lestari, 2023).

Cost and time efficiency are two very important aspects in any development project, especially in large construction projects. In an effort to improve this efficiency, the proper use of formwork plays a very important role. According to (Ferdinand & Adianto, 2022) Formwork serves as a mold to form concrete until it reaches the desired strength. However, the conventional formwork methods that are widely used today often face challenges, such as un reusable material residues and considerable time for the installation and dismantling process.

This study focuses on the evaluation of the use of formwork in the construction project of the Joint Lecture Building V of the University of Muhammadiyah Malang. Through this research, it is hoped that more efficient solutions can be found to increase productivity and effectiveness in development projects. This study also aims to provide an overview of the formwork method and its contribution to the development of best practices in the field of civil engineering, especially in the construction of educational buildings. Research conducted by

(Mamahit, Kushartomo, & Prabowo, 2023) emphasizing the importance of occupational safety and health factors in the use of formwork, which also affects the overall efficiency of the project.

In addition, external and internal factors also play an important role in the success of construction projects. Research by (Updated 2020) highlighting the importance of considering factors that affect project duration, including workforce experience and technology availability. In the context of formwork use, the selection of the right type of formwork must consider these factors in order to achieve optimal results in terms of cost and time.

The methods used in construction projects can directly affect productivity and cost efficiency. Previous research shows that the use of conventional formwork is still widely used in project construction. However, this formwork is not recommended for high-rise construction because there are still many more effective and efficient formwork methods. Cost and time efficiency are two very important aspects in any development project, especially in large construction projects.

This research focuses on the efficiency of the use of formwork in the construction project of the Joint Lecture Building V of the University of Muhammadiyah Malang. The results of this study are expected to provide better insight into the impact of efficient formwork use on cost savings and construction time. In addition, this research is expected to provide recommendations for project implementers and become a useful reference for academics and practitioners in the field of civil engineering, as well as support the improvement of quality and efficiency in construction projects in Indonesia.

2. LITERATURE REVIEW

The literature review in this study aims to provide a strong theoretical foundation regarding the use of formwork in construction projects, with a special focus on the use of conventional formwork. Formwork is a crucial element in the development process, because it serves to shape and hold concrete until it reaches the desired strength. Therefore, choosing the right type of formwork has a great effect on cost and time efficiency in a project.

In the development of the construction field, there are many more efficient formwork systems, with several advantages that include reduced installation and dismantling time, as well as reduced material waste. The formwork system is designed to be reusable, which reduces the need for new materials and speeds up the construction process. In the context of the construction of the Joint Lecture Building V of the University of Muhammadiyah, the use of aluminum formwork is expected to help reduce construction costs and time, which should be the top priority in this project.

Conventional formwork that is generally made of wood has some significant drawbacks. One of the main drawbacks is the unusable residual material after the dismantling process, which leads to waste of resources. In addition, the process of installing and disassembling conventional formwork often takes quite a long time. The quality of the wooden formwork also deteriorated after several uses, forcing

the contractor to make a new formwork. This process is not only time-consuming, but it also increases the overall cost of the project.

The time required for the installation and dismantling of conventional formwork tends to be longer because the process requires high precision and skill from the workers. This is in accordance with the findings reported by Yang showing that conventional formwork methods tend to take longer to implement compared to the use of more modern formwork systems, such as aluminum.(Widyawati, 2020)

In this study, according to Ihsan (2020), currently formwork is developing with many methods and materials used that affect the cost and time of carrying out the work.

In the context of the construction of the Joint Lecture Building V of the University of Muhammadiyah, the use of conventional formwork is expected to be the right formwork method in terms of effectiveness and efficiency. This research is in line with Research by (Dewi & Sembiring, 2022) who found that although the initial cost of modular or leased formwork systems is higher, the long-term savings on large projects, which reduce material waste and time, can offset those additional costs. Formwork allows for a significant reduction in material costs, since there is no need for the purchase of new formwork after some use, which is a major issue in conventional methods.

By understanding the various formwork methods available, including the advantages and disadvantages of each, it is necessary to analyze the cost and time of formwork work, especially conventional formwork as the purpose of this study. In addition, the results of this research are expected to provide useful insights for future construction project implementers.

3. RESEARCH METHODOLOGY

This study aims to analyze the method using conventional formwork and aluminum formwork. This method was used because there was a delay in the construction of the faculty building of the University of Muhammadiyah Malang. The Joint Lecture Building V project of the University of Muhammadiyah Malang is located in Dau District, Malang City. Precisely behind the University of Muhammadiyah Malang hospital. This building has an 11-storey building with the aim of being a place for students from various majors to learn.



Figure 3.1 Map of the location of the Joint Lecture Building V UMM

To complete this final project proposal, the author uses quantitative data, which focuses on measuring and analyzing data related to cost and time. In the development process, the method used is conventional formwork. The data used is project data from a supervision consultant at PT WIKA Gedung, Tbk. Data collection is carried out through two main sources, namely primary data and secondary data.

1. **Primary Data:** Primary data is obtained through direct observation at the project site, interviews with contractors and related parties, and measurement of time and costs incurred during the construction process. Observation aims to directly record the process of installing and dismantling formwork, as well as identify the time needed at each stage of work.
2. **Secondary Data:** Secondary data is obtained from project documents, financial statements, and relevant literature regarding the use of formwork in construction projects. The project documents used include work plans, budgets, and progress reports, which provide an overview of the costs and time spent on the project.

Once the data is collected, the analysis is carried out by comparing the cost and time required for each formwork method. The analysis process includes several stages:

1. **Cost:** A calculation of the total cost incurred for conventional formwork, including material, labor, and other overhead costs. The use of this cost calculation aims to assess the extent to which conventional formwork methods are applied.
2. **Time:** Measurement of the time required for the installation and dismantling of formwork using conventional methods. This time data will provide an overview of the speed and efficiency of the formwork method in the construction process.

3. **Statistical Analysis:** After the cost and time data are obtained, statistical analysis will be used to determine whether the conventional formwork method is appropriate for the construction of the Joint Lecture Building V of the University of Muhammadiyah Malang. This analysis technique will help assess the effectiveness in improving the overall efficiency of the project.

The results of the analysis will be interpreted to provide an understanding of the impact of the use of formwork on the cost and time of construction. The results of the study are expected to provide insight for project implementers regarding the importance of choosing the right formwork method to increase efficiency and reduce costs. The flow diagram of the discussion is shown in figure 2.

4. ANALYSIS AND DISCUSSION

The analysis and discussion in this study aims to determine the efficiency of the conventional formwork method in the context of the cost and time of the construction of the Joint Lecture Building V of the University of Muhammadiyah Malang. Conventional formwork is formwork that uses the main materials in the form of wood, multiplex, and board. Conventional formwork in the process is adjusted to the installation of the dimensions of the structure to be built. In general, according to (Rahadianto, Perwitasari, & Mashur, 2022) Conventional formwork is only used for two to three jobs with consideration of components that can still be used in the next process. The advantages of using conventional formwork are that the material is easy to find, the cost for pawnshops is cheap, can be used for various building structures, and has a flexible design in the implementation of wooden fields can be changed. Meanwhile, the disadvantages of using conventional formwork include that there are residual materials that can no longer be used for further formwork work. In addition, the use of conventional formwork takes longer and the quality used is not optimal.

The construction of conventional formwork in this study was carried out in the Joint Lecture Building V UMM with a total of 11 floors. Construction using conventional formwork has been considered from various aspects, both cost and work time.

The cost calculation in the construction of conventional formwork is carried out to determine the costs required in each construction method used during the implementation of a construction project. Meanwhile, the calculation of project work time is carried out to get an estimate of the time needed to complete the project.

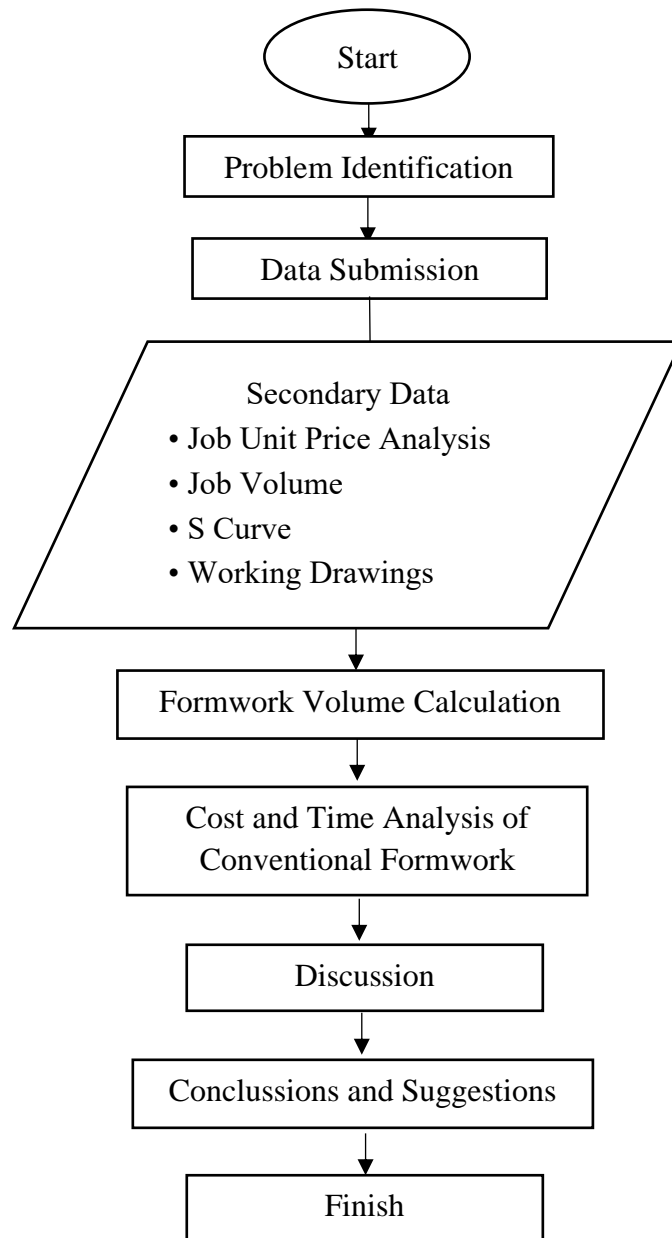


Figure 3.2 Flow Diagram

4.1 Analysis of the Cost of Using Conventional Formwork

The cost calculation is carried out on the construction of conventional formwork on the fourth to seventh floors assuming the volume of work and the number of workers varies. The unit price used in the construction of conventional formwork carried out in the construction of the Joint Lecture Building V UMM refers to the HSPK of the Malang City Government in 2022, including the cost of labor, materials, and equipment. The cost calculation is presented in the following table 1, which is a recapitulation of the total price of conventional formwork installation in the first, second, and third installations.

Table 4.1 Recapitulation of the First, Second, and Third Conventional Formwork Installation

Installation	Information	Total Price
First	Installation of 1m ² formwork for beams	IDR 311,280
Second	Installation of 1m ² formwork for beams (damage rate 15%)	IDR 114,675
Third	Installation of 1m ² formwork for beams (damage rate 30%)	IDR 149,370

On the first installation, the multiplex is not damaged. Meanwhile, in the installation of the second multiplex, the head wood, sengon wood, and bamboo crackers were damaged by 15%, causing the purchase of additional materials of 15% from the first installation. This is caused by the dismantling of the formwork during the first use. Then in the third installation also suffered damage of 30% from the first user. In the third installation, there was 30% damage to multiplexes, head wood, sengon wood, and cracked bamboo. So that there is an additional cost of 30% from the first installation. (Prakoso, 2022)

Furthermore, the use of beams, columns, stairs, and floor plates on the fourth to eleventh floors is presented in the recapitulation of table 2 as follows.

Table 4.2 Recapitulation of Installation of Conventional Formwork per Floor

Floor	Information	Total Price
4	First, second, and third usage fees for beams, columns, ladders, and floor plates	IDR 221.1657.30
5-6	First, second, and third usage fees for beams, columns, ladders, and floor plates	IDR 221.1657.30
7-8	First, second, and third usage fees for beams, columns, ladders, and floor plates	IDR 221.1657.30
9-10	First, second, and third usage fees for beams, columns, ladders, and floor plates	IDR 221.1657.30
11	First, second, and third usage fees for beams, columns, ladders, and floor plates	IDR 221.1657.30
Total		IDR 11,058,286.50

From the results of the recapitulation of the calculation of the installation of conventional formwork per floor, then the unit price that has been presented in the recapitulation above is multiplied by the volume of work obtained from the project data. In this case, it is presented in table 3 of the recapitulation of the calculation of

conventional formwork costs below.

Table 4.3 Recapitulation of Calculation of Conventional/Floor Formwork Costs

Floor	Sum
4	IDR 1,195,717,046.71
5-6	Rp. 978.294.480.14
7-8	Rp. 602.629.456.27
9-10	Rp. 505.641.507.52
11	Rp. 320.779.906.02

The calculation of the cost of work of this conventional formwork method is calculated based on the size on the figure *for construction* obtained from the project data. From the results of the overall recapitulation calculation of the construction of the conventional formwork project in the Joint Lecture Building V UMM amounted to Rp. 44,360,000,000.00. After knowing the cost needed in the construction of conventional formwork in the Joint Lecture Building V UMM, then the time calculation for the project work was carried out.

The calculation of time in the work of conventional formwork projects is carried out in the calculation of the installation of formwork in column work. To calculate the duration and productivity of workers, a list of conventional formwork labor coefficients per effective working day is needed based on the analysis of unit prices in 2022. Formwork work time is calculated with *the Microsoft Project* assistant program to control *resources* and other supporting data. This is because it is to adjust the duration of the work to the project's s-curve.

The application of working hours in the construction of conventional formwork uses normal working hours with 8 effective hours per day which can be applied starting at 08.00 – 12.00 and 13.00 – 17.00. The duration of work is measured based on the availability of existing human resources (HR) with details of the number of workers divided into various types of workers. The calculation of the duration is carried out using the volume of work that must be completed on each formwork item with a predetermined calculation format. The results of the recapitulation of the duration of the work carried out by *leveling* show that the duration of conventional formwork work is 59 days starting from January 8, 2024 to March 15, 2024.

5. CONCLUSIONS AND SUGGESTIONS

This study evaluates the use of conventional formwork in the construction project of the Joint Lecture Building V UMM. The results of the study show that conventional formwork requires a cost of Rp. 44,360,000,000.00 with a processing time of 59 days starting from January 8, 2024 to March 15, 2024. Based on the findings of this study, it is recommended to conduct a follow-up analysis related to

cost and time efficiency in the selection of alternative types of formwork work.

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