



LABOR COST ANALYSIS ON THE ACCELERATION OF ARCHITECTURAL WORK IMPLEMENTATION (CASE STUDY: FACULTY OF ECONOMICS AND BUSINESS BUILDING, UNIVERSITAS NEGERI SEMARANG)

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<p>Info Article</p> <p>Received: 04 Desember 2025</p> <p>Revised: 01 Januari 2026</p> <p>Accepted: 02 Februari 2026</p> <p>Publication: 28 Februari 2026</p> <p>Keywords: <i>Project Scheduling, Precedence Diagram Method (PDM), Project Duration, Labor Cost, Architectural Works.</i></p> <p>Kata Kunci: Penjadwalan Proyek, Precedence Diagram Method (PDM), Durasi Pekerjaan, Biaya Tenaga Kerja, Pekerjaan Arsitektur.</p> <p>Licensed Under a Creative Commons Attribution 4.0 International License</p> 	<p>Abstract: <i>Time and cost control are critical aspects in construction project implementation, particularly in architectural works that heavily depend on labor productivity. Delays in work completion may significantly increase labor costs. This study aims to compare normal scheduling and accelerated scheduling using the Precedence Diagram Method (PDM) and to analyze their impact on project duration and labor costs. The case study was conducted on the construction project of the Faculty of Economics and Business Building at Universitas Negeri Semarang, focusing on architectural works of the Basement and First floors. A quantitative method was employed using secondary data, including the Bill of Quantity, Budget Plan, weekly reports, and labor productivity data. The results indicate that normal scheduling produced a total duration of 478 days, while accelerated scheduling using PDM reduced the duration to 352 days and generated labor cost savings of Rp24,967,750. These findings demonstrate that PDM effectively improves time and labor cost efficiency in architectural building projects.</i></p> <p>Abstrak: Pengendalian waktu dan biaya merupakan aspek penting dalam pelaksanaan proyek konstruksi, khususnya pada pekerjaan arsitektur yang bergantung pada produktivitas tenaga kerja. Keterlambatan pekerjaan dapat meningkatkan biaya tenaga kerja secara signifikan. Penelitian ini bertujuan membandingkan penjadwalan durasi normal dan penjadwalan percepatan menggunakan Precedence Diagram Method (PDM) serta menganalisis pengaruhnya terhadap durasi dan biaya tenaga kerja. Studi kasus dilakukan pada Proyek Pembangunan Gedung Fakultas Ekonomi dan Bisnis Universitas Negeri Semarang dengan lingkup pekerjaan arsitektur lantai Basement dan lantai 1. Metode yang digunakan adalah kuantitatif dengan memanfaatkan data sekunder berupa Bill of Quantity, Rencana Anggaran Biaya, laporan mingguan, serta data produktivitas tenaga kerja. Hasil menunjukkan durasi normal 478 hari, sedangkan percepatan dengan PDM mengurangi durasi menjadi 352 hari dan menghasilkan penghematan biaya tenaga kerja sebesar Rp24.967.750. Penerapan PDM terbukti meningkatkan efisiensi waktu dan biaya pada pekerjaan arsitektur.</p>
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INTRODUCTION

In construction project implementation, time and cost control are two primary aspects that determine project success (Silalahi et al., 2023). Project delays often lead to increased execution costs, particularly labor costs, which constitute a significant portion of architectural works (Susanto & Wiyanto, 2025). Architectural work is highly dependent on labor productivity; therefore, proper planning and scheduling control are essential factors in achieving time and cost efficiency (Ardila et al., 2024).

One of the scheduling methods used in construction project management is the Precedence Diagram Method (PDM). According to Tamalika et al. (2025), this method enables flexible representation of dependency relationships among activities, facilitating the identification of the critical path within a project. By identifying the critical path, acceleration efforts can be focused on activities that directly influence the total project duration. The application of PDM is expected to support more effective decision-making in project acceleration without causing uncontrolled cost overruns (Romadhona et al., 2021).

The construction project of the Faculty of Economics and Business Building at Universitas Negeri Semarang is a multi-story building project with high architectural work complexity. Its implementation requires precise scheduling planning to ensure completion within the targeted timeframe while maintaining efficient labor utilization (Suparno, 2016). Therefore, scheduling analysis using the PDM method is relevant as an effort to accelerate project duration.

This study adopts a case study approach focusing on the architectural works of the Faculty of Economics and Business Building project at Universitas Negeri Semarang, with the scope of analysis limited to two floors of the building as research samples. This limitation was applied to obtain a more focused and in-depth analysis of both normal and accelerated scheduling implementations. Based on this background, the objective of this study is to compare the results of normal scheduling and accelerated scheduling using the Precedence Diagram Method (PDM) in architectural works and to evaluate the impact of the method's implementation on project duration and labor costs.

METHOD

Research Approach and Type

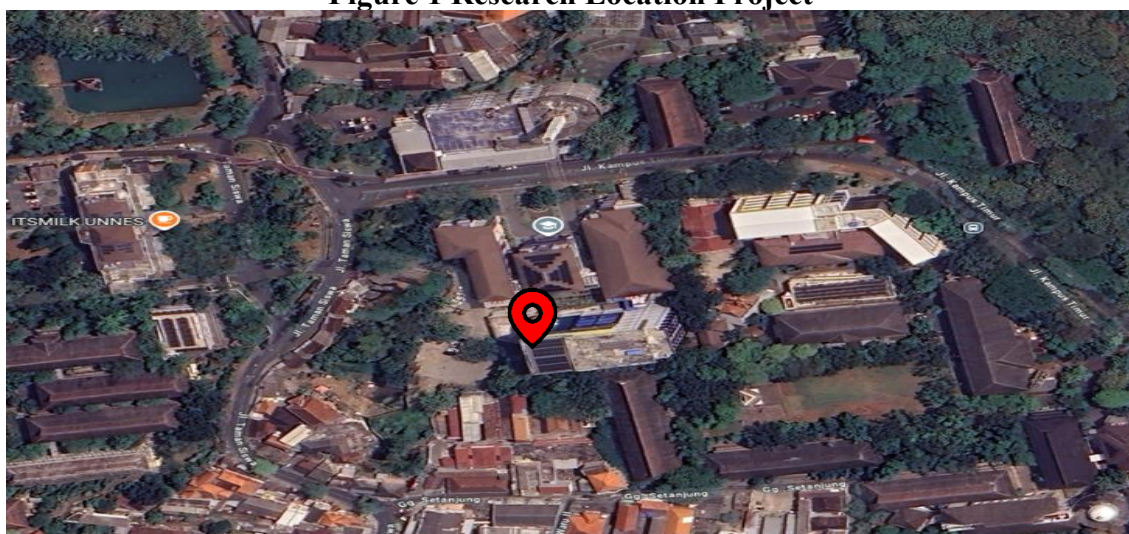
This study employs a quantitative research method by collecting numerical data aimed at measuring variables and analyzing the relationships among variables using

statistical methods. The quantitative approach is applied through analytical calculations to support and validate the research problem. In this study, the quantitative method is used to determine labor acceleration costs in architectural works using the Precedence Diagram Method (PDM).

Research Location and Object

The data used as a case study were derived from the architectural works of the Faculty of Economics and Business Building construction project at Universitas Negeri Semarang. The analysis scope was limited to two building floors: the Basement floor and the First floor.

Figure 1 Research Location Project



Source: Google Maps, 2026

Data and Data Sources

The research data source is the Faculty of Economics and Business Building construction project at Universitas Negeri Semarang. This study utilizes only secondary data, including:

- Bill of Quantity (BoQ)
- Budget Plan (Rencana Anggaran Biaya – RAB)
- Weekly Reports

Data Collection Techniques

Data collection was conducted through:

1. Observation, by directly reviewing records and project archives obtained from the project executor and other supporting data.

- Literature review, by collecting references from books and scientific journals containing theoretical foundations and calculation formulas supporting this research.

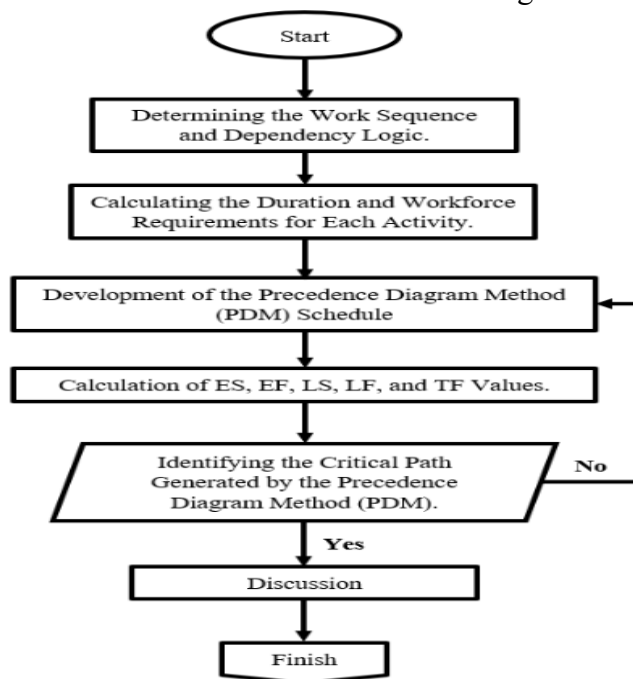
Research Stages

The research stages include:

- Identifying problems arising in scheduling with actual duration conditions.
- Conducting a literature review on project scheduling, the PDM method, and labor cost analysis.
- Collecting secondary data, including BoQ, RAB, weekly reports, work duration, working hours and days, and activity sequences.
- Processing and analyzing data to develop actual-duration scheduling based on labor productivity, workforce quantity, work duration, and labor costs using Microsoft Excel and Microsoft Project.
- Identifying critical path activities as the basis for work acceleration.
- Rescheduling using the PDM method by applying accelerated durations to critical path activities.
- Analyzing and comparing labor costs between actual-duration scheduling and accelerated scheduling using PDM.
- Drawing conclusions and providing recommendations based on the analysis results.

The research flowchart of the Precedence Diagram Method is presented in Figure 2.

Figure 1 The research flowchart of the Precedence Diagram Method (PDM)



Source: Author’s Document, 2025

RESULTS AND DISCUSSION

Result

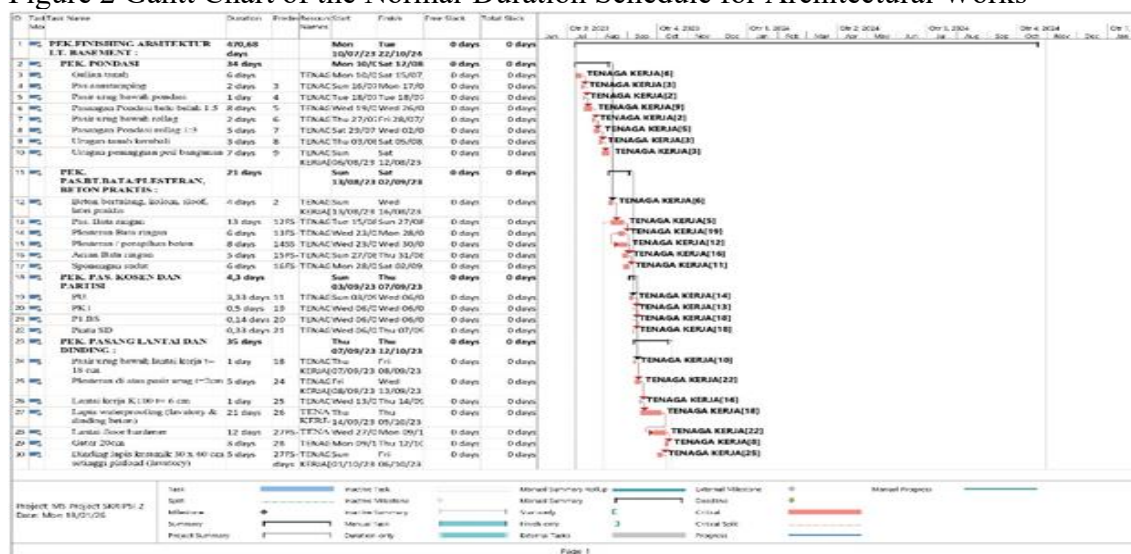
Normal Scheduling Duration

The analysis began with the preparation of a normal-duration schedule based on actual implementation conditions without acceleration. The duration of each activity was calculated by considering work volume, labor productivity, normal workforce size, and standard working hours. Activity dependencies were then arranged according to on-site execution sequences.

The network model was developed using the Precedence Diagram Method (PDM), primarily applying Finish-to-Start (FS) relationships and, where applicable, Start-to-Start (SS) relationships to allow parallel execution. The normal schedule was analyzed to identify the critical path using Microsoft Project. Activities on the critical path served as the basis for acceleration.

The results indicated that the total duration of architectural works for the two analyzed floors was 478 days.

Figure 2 Gantt Chart of the Normal-Duration Schedule for Architectural Works



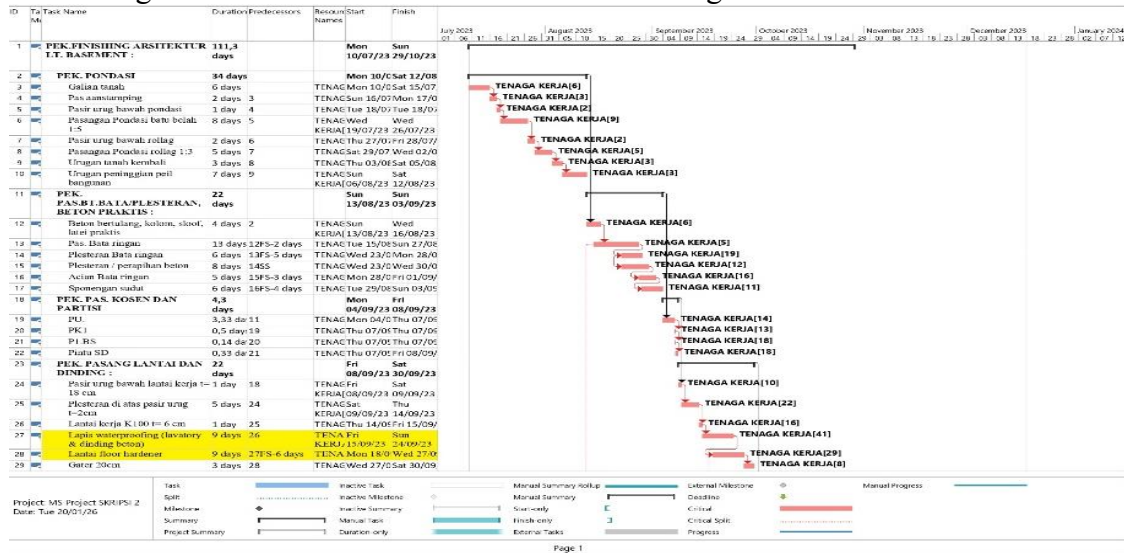
Source: Author’s Analysis, 2026

Accelerated Scheduling Duration

Based on the results of the accelerated scheduling analysis for the architectural works of the Faculty of Economics and Business Building at Universitas Negeri Semarang, the total duration for the two analyzed floors was reduced to 352 days. The scheduling acceleration was implemented using the Precedence Diagram Method (PDM) by adjusting the number of workers assigned to activities on the critical path, without

introducing overtime hours. The preparation of the accelerated schedule was carried out while maintaining the dependency relationships among activities according to the actual execution sequence in the field. Activities subjected to acceleration are highlighted in yellow, as shown in Figure 4.

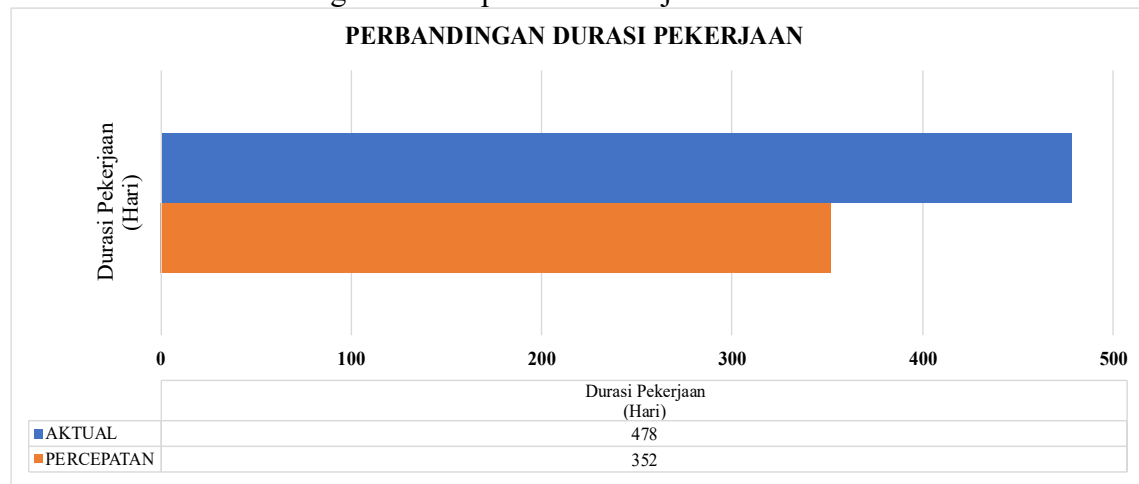
Figure 3 Gantt Chart of Accelerated Scheduling for Architectural Works



Source: Author’s Analysis, 2026

The analysis results indicate that the implementation of acceleration on critical path activities successfully reduced the total project duration compared to the normal scheduling scenario. Activities outside the critical path did not experience changes in duration, allowing acceleration efforts to be selectively focused on specific tasks that directly influence the overall project duration. These findings demonstrate that the Precedence Diagram Method (PDM) is effective as a basis for planning the acceleration of architectural work scheduling.

Figure 4 Comparison of Project Durations



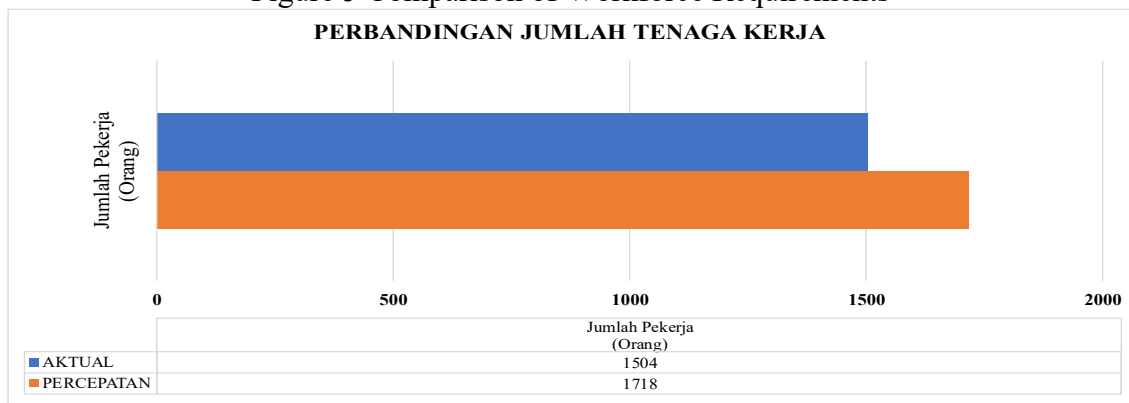
Source: Data Analysis, 2026

Changes in Workforce Quantity

The study identified differences in workforce requirements between the normal and accelerated scheduling scenarios. This difference arises from the implementation of accelerated scheduling, whereby a reduction in the duration of specific work items necessitates adjustments in the number of workers required to complete those items within the shortened timeframe. Changes in workforce allocation were implemented as part of the acceleration strategy for the architectural works of the Faculty of Economics and Business Building at Universitas Negeri Semarang, covering the Basement to the First floor.

Under the normal scheduling scenario, workforce requirements were determined based on initial implementation conditions and standard labor productivity calculations. In contrast, the accelerated scheduling scenario involved adjustments to the number of workers assigned to several activities on the critical path. The analysis indicates that the total workforce requirement under the actual duration was 1,504 worker-days, while the accelerated duration required 1,718 worker-days. These results demonstrate that increasing the workforce on critical path activities directly contributed to the overall reduction in project duration.

Figure 5 Comparison of Workforce Requirements

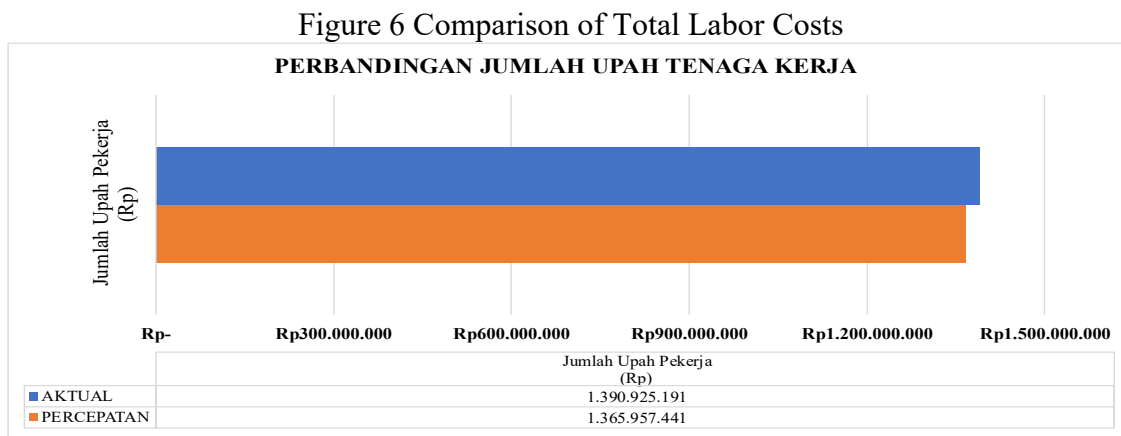


Source: Data Analysis, 2026

Comparison of Labor Costs

A comparison of labor costs was conducted to evaluate the impact of implementing accelerated scheduling using the Precedence Diagram Method (PDM) on the architectural works of the Faculty of Economics and Business Building at Universitas Negeri Semarang. Under the normal scheduling scenario, the total labor wage cost for the Basement and First floors amounted to Rp1,390,925,191. After acceleration was implemented through adjustments in workforce allocation on critical path activities

without the addition of overtime hours, the total labor wage cost decreased to Rp1,365,957,441. The comparison results indicate that the implementation of accelerated scheduling generated labor cost savings of Rp24,967,750. This cost reduction occurred due to the significant decrease in project duration, which reduced the total time of labor utilization despite the increase in workforce assigned to certain activities. These findings demonstrate that properly planned acceleration using the PDM method can enhance labor cost efficiency in the analyzed architectural works.



Source: Data Analysis, 2026

Comparative Summary

The research findings indicate that the reduction in project duration resulted in a shorter total period of labor utilization. Consequently, although the number of workers increased in certain activities, the overall accumulation of labor costs could still be reduced. To examine the effect of accelerated scheduling on project duration and labor costs in the architectural works of the Faculty of Economics and Business Building at Universitas Negeri Semarang, a comparison was conducted between normal scheduling and accelerated scheduling. The comparison focused on total project duration and total labor costs within the scope of the two analyzed floors. The results of this comparison are presented in Table 1.

Table 1 Comparison of Project Duration, Workforce Requirements, and Labor Costs

Description	Normal Scheduling	Accelerated Scheduling	Difference
Work Duration (Days)	478	352	126
Workforce (Worker-days)	1504	1718	214
Labor Cost (Rp)	Rp1.390.925.191	Rp1.365.957.441	Rp24.967.750

Source: Author’s Research, 2026

As shown in Table 1, the implementation of accelerated scheduling using the Precedence Diagram Method (PDM) reduced the duration of architectural works by 126 days compared to the normal scheduling scenario. In addition, labor costs decreased by Rp24,967,750. This reduction occurred due to the significant shortening of the project duration, which reduced the total period of labor utilization despite the addition of 214 worker-days allocated to activities on the critical path.

CONCLUSION

The findings of this study indicate that the implementation of the Precedence Diagram Method (PDM) in developing and analyzing project schedules and labor cost calculations is proven to be effective through critical path identification. As a result, workforce requirements, project duration, and labor wage costs can be optimized more efficiently compared to normal or actual scheduling conditions. Based on the scheduling analysis of the architectural works of the Faculty of Economics and Business Building at Universitas Negeri Semarang, the normal scheduling scenario for the two analyzed floors (Basement–First Floor) resulted in a total project duration of 478 days. This schedule was developed based on actual implementation conditions without acceleration and served as the baseline for further analysis.

The implementation of accelerated scheduling using the PDM method focused on activities along the critical path through adjustments in workforce allocation without adding overtime hours, thereby reducing the project duration to 352 days. This demonstrates that PDM is effective in planning controlled and systematic acceleration of architectural work schedules. In terms of labor costs, the acceleration strategy also resulted in cost efficiency. The total labor cost under normal scheduling amounted to Rp1,390,925,191, while the accelerated scheduling reduced the cost to Rp1,365,957,441, generating savings of Rp24,967,750. These results indicate that well-planned scheduling acceleration does not necessarily increase costs; instead, it can simultaneously improve both time efficiency and labor cost efficiency. Therefore, the PDM method can serve as an effective decision-support tool in project scheduling, particularly for architectural works characterized by repetitive tasks and interdependent activities.

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