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Analysis of Road and Drainage Project Performance Control Using the Earned Value Method: A Case Study of Road and Drainage Work Row 46 Segment II Jakarta Garden City

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ABSTRACT

Construction project control is very important to achieve project performance in accordance with the plan that has been set and is essential to implement, especially in relation to cost, quality, and time. The methods commonly used to carry out control are the Conventional Cost Management Method and the Earned Value Method, where both methods share the same goal: to control project performance so that the project is executed according to the plan. The purpose of this study is to evaluate and analyze the performance of the Road and Drainage Project in Row 46 Segment II, Jakarta Garden City, by applying both the Conventional Cost Management Method and the Earned Value Method (EVM). Using a descriptive research approach, primary and secondary data were collected through field surveys, documentation, and project reports over a sixteen-week period. The findings reveal that in week 7, the project was ahead of schedule (schedule underrun) but incurred higher costs (cost overrun), whereas by week 16, delays (schedule overrun) were observed alongside continued cost overruns. EVM demonstrated superior capability in monitoring deviations and forecasting final project costs and completion timelines through indicators such as SPI and CPI. The research concludes that EVM offers a more dynamic and precise tool for project control, enabling timely corrective measures and improved decision-making compared to conventional approaches.

KEYWORDS *Earned Value, Conventional Methods, Project Performance, Indicators*

INTRODUCTION

Construction projects are a series of activities that involve planning, design, and both buildings and infrastructure, with the main goal of creating a building that is functional, safe, and in accordance with predetermined specifications (Olanrewaju, 2025; Uddin, 2025). These projects have a relatively short period of time, with clear start and end points. At the implementation stage in the field, irregularities often occur in terms of cost, quality, and time (Andersen, Grude, & Haug, 2025; Kerzner, 2025). To minimize these issues, good and appropriate control of the work implementation is needed so that the work carried out aligns with the planned objectives (Faizah, Thohir, & Salem, 2025; Ugwu et al., 2025).

The global construction industry faces unprecedented challenges in project delivery, with cost overruns and schedule delays remaining persistent problems across developed and developing nations (Giri, 2025; Rajapakshe, 2025). According to recent international studies, approximately 70% of construction projects worldwide experience cost overruns averaging 27.6% above initial budgets, while 60% face schedule delays averaging 36.5% beyond planned completion dates (Gah, 2024; Tesfaye, 2022). These systemic issues result in significant economic losses, estimated at over $1.5 trillion annually globally, and undermine stakeholder confidence in the construction sector (Mughal, 2023; Toochukwu, 2025). The complexity of modern construction projects—involving multiple stakeholders, intricate supply chains, dynamic site conditions, and increasingly stringent quality requirements—necessitates robust performance monitoring and control systems that can provide real-time insights into project health and enable proactive corrective actions.

Traditional project management approaches have proven inadequate in addressing these challenges, particularly in their inability to integrate cost, schedule, and scope performance into unified metrics that facilitate comprehensive decision-making (Kerzner, 2023). The emergence of *Earned Value Management (EVM)* as a systematic methodology for measuring project performance has gained significant traction internationally, with adoption rates increasing substantially in both public and private sector construction projects (Alexander, 2025; Elsaid, Nassar, Alqahtani, & Abotaleb, 2025). Studies from the United States, Europe, and Asia have demonstrated that *EVM* implementation can reduce cost overruns by 15-25% and schedule delays by 20-30% compared to conventional monitoring methods (Muharremi, 2025; Saffirio, 2023). However, despite its proven effectiveness, *EVM* adoption in developing countries remains limited, with conventional cost tracking methods still dominating project control practices in many emerging economies (Alotaibi, Sohail, & Soetanto, 2025; Ojo, Ogunsemi, Elyamany, & Oke, 2025).

In Indonesia, the construction sector contributes significantly to national GDP, accounting for approximately 10.3% of the economy and employing over 7.8 million workers (BPS, 2024). However, the Indonesian construction industry continues to face severe performance challenges, with studies indicating that 65% of infrastructure projects experience cost overruns exceeding 20%, and 58% face schedule delays beyond three months (Irankunda et al., 2025; Whitely, 2025).A comprehensive analysis by the Ministry of Public Works and Housing (PUPR) revealed that inadequate project monitoring and control systems constitute the primary contributing factors to these failures, accounting for 42% of documented project problems (Kementerian PUPR, 2023). The economic implications are substantial, with annual losses from project inefficiencies estimated at Rp 127 trillion ($8.5 billion), representing a significant drain on development resources and taxpayer funds (BPKP, 2024).

Several recent studies have examined the application of Earned Value Management in construction projects, providing important insights into its effectiveness and implementation challenges (Das, Khursheed, & Paul, 2025; Setyopurnomo, Wiryono, Lestari, & Sukarno, 2025). Narbaev and De Marco (2014) conducted a comprehensive meta-analysis of EVM accuracy across 23 construction projects, demonstrating that EVM forecasting exhibits mean absolute percentage errors of 8-12% for cost estimates and 6-10% for schedule predictions, significantly outperforming conventional methods. Their research established that EVM reliability improves substantially after 20% project completion, with optimal forecasting accuracy achieved between 30-60% completion stages. Kim et al. (2020) advanced this understanding by developing an enhanced EVM framework integrating risk analysis, demonstrating through 15 Korean infrastructure projects that risk-adjusted EVM models improve prediction accuracy by 18-23% compared to standard EVM applications. Their study emphasized the importance of context-specific calibration of EVM indices to account for project-specific uncertainty factors (Petraitis, 2025).

Complementing these studies, Agyei-Mensah (2019) conducted a systematic literature review of EVM applications in developing countries, identifying critical success factors including management commitment, staff training, data quality assurance, and standardized implementation protocols. Chen and Lin (2021) introduced machine learning enhancements to traditional EVM, demonstrating through Taiwanese construction cases that AI-augmented EVM can improve forecast accuracy by 20-35%, particularly in projects characterized by high uncertainty and complexity. However, their study also highlighted the substantial data requirements and technical expertise needed for such advanced implementations, suggesting that traditional EVM remains most practical for typical construction projects.

Significant gaps remain in understanding EVM's effectiveness within specific Indonesian construction contexts (Widyarso, Witjaksana, & Purnama, 2025). Current research has predominantly focused on large-scale infrastructure, neglecting the distinct challenges of medium-scale urban development projects, which form a substantial part of the industry. Furthermore, comparative analyses of EVM and conventional methods are often retrospective or simulated, lacking real-time assessment on active projects. The unique implementation dynamics in Jakarta, influenced by local regulations and market conditions, are also poorly documented, leaving practitioners without clear, localized guidance (Reshetova & Hartley, 2025).

To address these deficits, this research provides a novel, longitudinal evaluation of EVM versus conventional methods on an ongoing, medium-scale road and drainage project in Jakarta. It systematically assesses all four EAC forecasting alternatives for accuracy within the local context and documents the real-world implementation process and challenges. By focusing on this common but understudied project type, the study demonstrates how EVM's integrated performance indices enable earlier problem detection and more proactive management, offering empirical evidence and practical insights to improve project control practices in Indonesia.

Given the persistent challenges in Indonesian construction project performance and the demonstrated potential of Earned Value Management to enhance project control effectiveness, this research becomes critically urgent. The findings will provide evidence-based guidance for Indonesian construction firms, government agencies, and project management professionals seeking to improve project delivery outcomes and reduce the substantial economic losses currently attributed to inadequate monitoring and control practices.

The purpose of this study intends to evaluate and analyze "Kinerja Proyek" using Conventional Cost Management Method and Earned Value Method in "Pekerjaan Jalan dan Saluran Air Baris 46 Segmen II di Jakarta Garden City wilayah Jakarta Timur". The scope and limitations of the problem in writing this research paper are evaluating and analyzing project performance with Conventional Cost Management Methods and Earned Value Method, using project data from the first to the fourth month of the six-month completion plan.

The findings from this research will provide significant practical benefits to multiple stakeholder groups. For construction contractors and project managers, the study offers empirical evidence regarding the relative advantages of EVM versus conventional approaches, supporting informed decisions about methodology adoption and providing practical implementation guidance. For government agencies and project owners, the research demonstrates the potential return on investment from requiring or incentivizing EVM adoption in public infrastructure projects, potentially informing policy and contract administration improvements. For construction management educators and trainers, the study provides a case-based teaching resource that illustrates EVM concepts through actual project application, enhancing the practical relevance of academic instruction. Finally, for the broader construction industry in Indonesia, this research contributes to the development of an evidence base supporting the professionalization of project management practices and the adoption of internationally recognized best practices adapted to local contexts.

Finally, this research contributes methodologically by demonstrating a rigorous yet practical approach to implementing comparative project control methodology studies in field settings, establishing a template that can be replicated in other Indonesian construction contexts to build cumulative evidence regarding optimal project management practices. The detailed documentation of data collection procedures, calculation protocols, and analytical frameworks provided in this study enables both academic researchers and industry practitioners to assess study validity and replicate the methodology in their own contexts.

METHOD

This research employed a descriptive methodology, relying on the collection and analysis of both primary and secondary data. The necessary information was gathered through field surveys, direct observations, photography at the project site, and by reviewing implementation documents such as cost budgets and physical progress reports. Supplementary data was also sourced from relevant literature, books, and scientific journals to support the research theme.

The data collection process involved two main techniques: observation and documentation. Direct observation was conducted at the project site across various stages of work, while documentation involved taking photographs of the ongoing field implementation. The data was categorized into primary data, obtained firsthand from the field, and secondary data, which included project documents such as cost budgets, time schedules, and progress reports, alongside academic references.

Subsequently, the collected data was processed and analyzed using two specific methods: conventional cost management and the Earned Value Method (EVM). Each method was applied according to its established parameters and indicators. This analytical process involved calculating and examining these indicators to evaluate project performance, ultimately providing clear results that aligned with the research objectives and facilitated a comprehensive discussion.

RESULT AND DISCUSSION

Analysis of Calculation Results

The cumulative value of the plan cost, the cumulative value of the realization cost and the cumulative value of the deviation cost above show that:

a. Until the 7th week, the time of implementation of work in the field has progressed from the time of the plan with greater costs, this is shown from the image of the S-graph of the realization is "above" the S-graph of the plan. The cumulative value of each fee up to week 7 is as follows:

Plan cost value	Rp. 1,829,469,834.63
Reduce the cost of realization	Rp. 1,934,642,497.46
Cost deviation value	Rp. 105,172,662.82

b. Until the 16th week, the execution time of the work is delayed from the planned time with less costs, this is shown from the S-graph image of the realization being "below" the plan's S-graph. The cumulative value of each fee up to week 16 is as follows:

Plan cost value Rp. 6,583,139,746.85
Value of realization costs Rp. 5,359,737,525.68
Cost deviation value (minus) Rp. 1,223,402,221.17

By paying attention to the above, it shows that until the 7th week the project performance progresses with a greater cost and from the 8th to the 16th week there is a delay with the cost incurred less than the plan cost, so thus the time of implementation of the work will be faster or slower depending on how much cost is spent on the implementation of the work or in other words the time The implementation will be directly proportional to the costs incurred.

Earned Value Method Analysis

The calculation and analysis for Earned Value indicators such as BCWS, BCWP, and ACWP, are taken as an example of calculations in week 7 and week 16, with a Budget At Completion (BAC) value of Rp. 8,464,200,000.00 according to table IV.2, which is as follows:

1) Calculation of Earned Value Indicators

a. Calculation of BCWS (Budgeted Cost of Work Schedule) or Plan Value (PV)

The value of BCWS or PV is obtained from the result of the multiplication between the weight of the plan and the value of the Budget at Completion (BAC) cost budget, which is as follows:

General Formula

BCWS = % Weight of the plan per week x Project Budget Value (BAC)

Week 7, Plan progress weight: 4.55%

BCWS = 4.55% x Rp. Rp. 8,464,200,000.00
= Rp. 384,832,539.87

Week 16, Plan progress weight 6.55%

BCWS = 6.55% x Rp. Rp. 8,464,200,000.00
= Rp. 554,265,442.10

From the results of the calculation above, the BCWS value for the 7th week is Rp. 384,832,539.87 and the 16th week is Rp. 554,265,442.10 The value of the BCWS calculation results can be seen in table 1.

Tabel 1. Nilai BCWS (Budgeted Cost of Work Schedule)

Week	Plan Progress Weight		BCWS Plan Value	
	Per Week	Cumulative	Per Week	Cumulative
1	0.03%	0.03%	Rp 2,389,136.74	Rp 2,389,136.74
2	1.55%	1.58%	Rp 131,440,023.79	Rp 133,829,160.53
3	1.28%	2.86%	Rp 108,506,869.11	Rp 242,336,029.64
4	3.07%	5.93%	Rp 259,975,570.91	Rp 502,311,600.55
5	4.18%	10.11%	Rp 353,650,005.37	Rp 855,961,605.92
6	4.01%	14.12%	Rp 339,307,749.55	Rp 1,195,269,355.46
7	4.55%	18.67%	Rp 384,832,539.87	Rp 1,580,101,895.34
8	4.19%	22.86%	Rp 354,605,290.48	Rp 1,934,707,185.82
9	3.88%	26.74%	Rp 328,446,911.27	Rp 2,263,154,097.09
10	5.71%	32.45%	Rp 483,549,528.08	Rp 2,746,703,625.17
11	5.29%	37.75%	Rp 448,131,591.87	Rp 3,194,835,217.04
12	5.65%	43.40%	Rp 478,341,164.31	Rp 3,673,176,381.35

Week	Plan Progress Weight		BCWS Plan Value	
	Per Week	Cumulative	Per Week	Cumulative
13	5.61%	49.01%	Rp 474,839,632.83	Rp 4,148,016,014.18
14	5.49%	54.50%	Rp 464,712,668.84	Rp 4,612,728,683.02
15	6.13%	60.63%	Rp 518,823,369.30	Rp 5,131,552,052.32
16	6.55%	67.17%	Rp 554,265,442.10	Rp 5,685,817,494.42
17	6.88%	74.06%	Rp 582,371,203.93	Rp 6,268,188,698.34
18	6.58%	80.63%	Rp 556,584,644.09	Rp 6,824,773,342.43
19	4.83%	85.46%	Rp 408,469,036.72	Rp 7,233,242,379.15
20	4.05%	89.51%	Rp 343,174,446.04	Rp 7,576,416,825.19
21	4.04%	93.55%	Rp 341,605,806.54	Rp 7,918,022,631.73
22	2.93%	96.47%	Rp 247,663,109.87	Rp 8,165,685,741.60
23	2.09%	98.56%	Rp 176,999,502.76	Rp 8,342,685,244.35
24	1.25%	99.82%	Rp 106,083,811.39	Rp 8,448,769,055.75
25	0.11%	99.93%	Rp 9,543,440.53	Rp 8,458,312,496.28
26	0.07%	100.00%	Rp 5,958,172.82	Rp 8,464,270,669.10

Data Source: Analysis Results

b. Calculation of BCWP (Budgeted Cost of Work Performed) or Earned Value (EV)

The value of BCWP or EV is obtained from the result of multiplying the weight of the realization of work in the field and the value of the planned Budget at Completion (BAC) cost budget.

General Formula

BCWP = % Weight of realization per week x Project Budget Value (BAC)

Week 7, Weight of plan progress 0.70%

BCWP = 0.70 % x Rp. 8,464,200,000.00

= Rp. 59,414,712.85

Week 16, Plan progress weight 6.55%

BCWP = 6.55 % x Rp. 8,464,200,000.00

= Rp. 229,554,331.90

From the results of the calculation above, the BCWP value for the 7th week is Rp. 59,414,712.85 and the 16th week is Rp. 229,554,332.90. The value of the results of the BCWP calculation can be seen in table 2.

Tabel 2. Nilai BCWP (Budgeted Cost of Work Performed) or Earned Value (EV)

Week	Realization Progress Weight		BCWS Realization Value	
	Per Week	Cumulative	Per Week	Cumulative
1	0.23%	0.23%	Rp 19,497,407.20	Rp 19,497,407.20
2	2.40%	2.63%	Rp 203,513,055.05	Rp 223,010,462.25
3	5.05%	7.68%	Rp 427,046,670.07	Rp 650,057,132.32
4	1.83%	9.51%	Rp 154,829,816.01	Rp 804,886,948.33
5	6.70%	16.21%	Rp 567,101,400.00	Rp 1,371,988,348.33
6	2.83%	19.04%	Rp 239,535,819.12	Rp 1,611,524,167.45
7	0.70%	19.74%	Rp 59,414,712.85	Rp 1,670,938,880.30
8	2.59%	22.33%	Rp 219,345,236.89	Rp 1,890,284,117.19
9	2.51%	24.84%	Rp 212,236,775.01	Rp 2,102,520,892.20
10	2.84%	27.68%	Rp 240,258,997.66	Rp 2,342,779,889.86
11	3.69%	31.37%	Rp 312,620,024.47	Rp 2,655,399,914.33
12	9.75%	41.12%	Rp 824,894,642.68	Rp 3,480,294,557.01

Week	Realization Progress Weight		BCWS Realization Value	
	Per Week	Cumulative	Per Week	Cumulative
13	2.95%	44.06%	Rp 249,439,492.23	Rp 3,729,734,049.24
14	3.99%	48.06%	Rp 337,857,653.30	Rp 4,067,591,702.54
15	3.92%	51.98%	Rp 332,026,451.76	Rp 4,399,618,154.30
16	2.71%	54.69%	Rp 229,554,331.90	Rp 4,629,172,486.21

Data Source: Analysis Results

c. Calculation of ACWP (Actual Cost of Work Performed) or Actual Cost (AC) value

The value of ACWP or Actual Cost (AC) is obtained from accounting/financial data consisting of direct costs and indirect costs including office and field overhead costs at the time of reporting as well as other costs related to project expenses. The data is recap and accumulated as seen in table IV.3 and the recapitulation value of Actual Cost (AC) can be seen in table 3.

Table 3. ACWP (Actual Cost of Work Performance) or Actual Cost (AC) value

Week	ACWP Realization Value or AC	
	Per Week	Cumulative
1	Rp 609,718,000.00	Rp 609,718,000.00
2	Rp 370,283,970.00	Rp 980,001,970.00
3	Rp 192,385,050.00	Rp 1,172,387,020.00
4	Rp 164,361,400.00	Rp 1,336,748,420.00
5	Rp 483,883,550.00	Rp 1,820,631,970.00
6	Rp 659,331,550.00	Rp 2,479,963,520.00
7	Rp 145,505,000.00	Rp 2,625,468,520.00
8	Rp 156,400,800.00	Rp 2,781,869,320.00
9	Rp 216,121,000.00	Rp 2,997,990,320.00
10	Rp 342,617,736.36	Rp 3,340,608,056.36
11	Rp 480,755,800.00	Rp 3,821,363,856.36
12	Rp 688,732,395.45	Rp 4,510,096,251.82
13	Rp 112,117,900.00	Rp 4,622,214,151.82
14	Rp 256,610,509.00	Rp 4,878,824,660.82
15	Rp 102,551,500.00	Rp 4,981,376,160.82
16	Rp 779,794,050.00	Rp 5,761,170,210.82

Data Source: Contractor

d. Cumulative Value Recapitulation of BCWS, BCWP and ACWP

The cumulative values of BCWS or PV, BCWP or EV and ACWP or AC can be seen in table 4 and the graph of the relationship between the cumulative recapitulation values of BCWS, BCWP and ACWP can be seen in figure 1.

Table 4. Cumulative Comparative Values of BCWS or PV, BCWP or EV and ACWP or AC

Week	Value		
	BCWS or PV	BCWP or EV	ACWP or AC
1	Rp 2,389,136.74	Rp 19,497,407.20	Rp 609,718,000.00
2	Rp 133,829,160.53	Rp 223,010,462.25	Rp 980,001,970.00
3	Rp 242,336,029.64	Rp 650,057,132.32	Rp 1,172,387,020.00
4	Rp 502,311,600.55	Rp 804,886,948.33	Rp 1,336,748,420.00
5	Rp 855,961,605.92	Rp 1,371,988,348.33	Rp 1,820,631,970.00

Week	Value		
	BCWS or PV	BCWP or EV	ACWP or AC
6	Rp 1,195,269,355.46	Rp 1,611,524,167.45	Rp 2,479,963,520.00
7	Rp 1,580,101,895.34	Rp 1,670,938,880.30	Rp 2,625,468,520.00
8	Rp 1,934,707,185.82	Rp 1,890,284,117.19	Rp 2,781,869,320.00
9	Rp 2,263,154,097.09	Rp 2,102,520,892.20	Rp 2,997,990,320.00
10	Rp 2,746,703,625.17	Rp 2,342,779,889.86	Rp 3,340,608,056.36
11	Rp 3,194,835,217.04	Rp 2,655,399,914.33	Rp 3,821,363,856.36
12	Rp 3,673,176,381.35	Rp 3,480,294,557.01	Rp 4,510,096,251.82
13	Rp 4,148,016,014.18	Rp 3,729,734,049.24	Rp 4,622,214,151.82
14	Rp 4,612,728,683.02	Rp 4,067,591,702.54	Rp 4,878,824,660.82
15	Rp 5,131,552,052.32	Rp 4,399,618,154.30	Rp 4,981,376,160.82
16	Rp 5,685,817,494.42	Rp 4,629,172,486.21	Rp 5,761,170,210.82

Data Source: Analysis Results

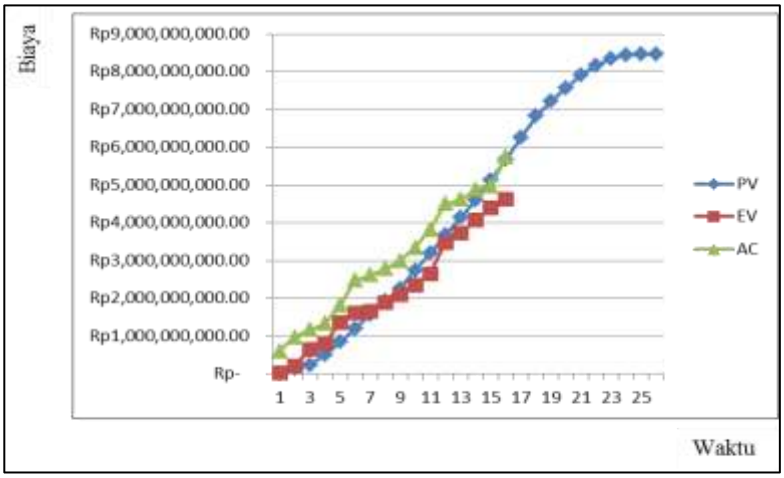

Figure 1. Cumulative Value Relationship Graph BCWS (PV), BCWP (EV) and ACWP (AC)

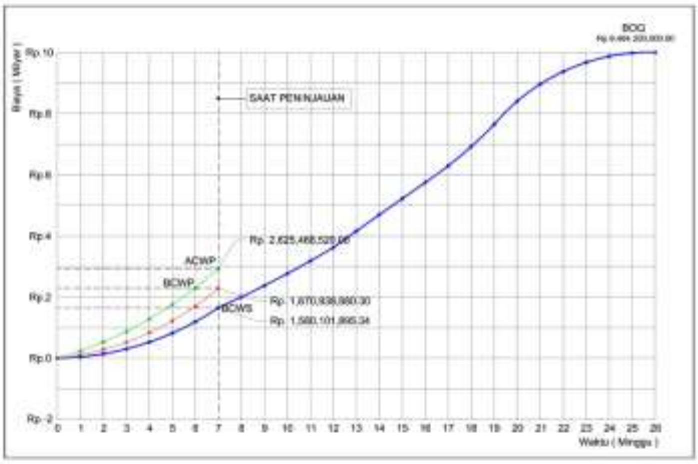

Figure 2. Cumulative Value Relationship Graph of BCWS, BCWP and ACWP Until Week 7

Source: Analysis Results

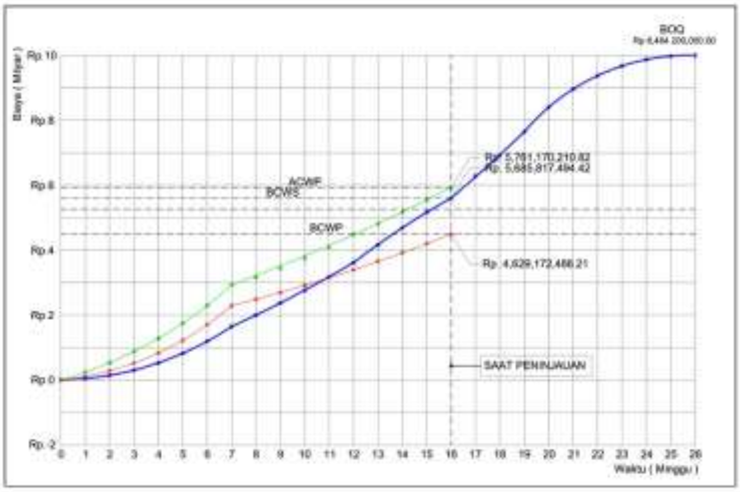

Figure 3. Cumulative Value Relationship Graph of BCWS, BCWP and ACWP Until Week 16

Source: Analysis Results

2) *Analysis of Variance Value Calculation*

The analysis of the calculation of the value of variance consists of cost variance (CV) and schedule variance (SV), which are as follows:

a. Calculating Cost Variance (CV) Parameters

An example of the calculation is repeated in week 7 and week 16, with the following calculations:

General formula CV = EV – AC

Week 7

CV = Rp. 1,670,938,880.30 – Rp. 2,625,468,520.00
= (-) Rp. 954,529,639.70

Week 16

CV = Rp. 4,629,172,486.21 – Rp. 5,761,170,210.82
= (-) Rp. 1,131,997,724.61

b. Calculating Schedule Variance (SV) Parameters

General formula SV = EV – PV

Week 7

SV = Rp. 1,670,938,880.30 – Rp. 1,580,101,895.34
= Rs. 90,836,984.97

Week 16

SV = Rp. 4,629,172,486.21 – Rp5,685,817,494.42
= (-) Rp. 1,056,645,008.21

From the results of the calculation above, the Cost Variance (CV) value in week 7 was obtained of (-) Rp. 954,529,639.70 and the Schedule Variance (SV) value was positive (+) Rp. 90,836,984.97 while for the 16th week the value of Cost Variance (CV) is (-)Rp. 1,131,997,724.6 and the value of Schedule Variance (SV) is negative (-) Rp. 1,056,645,008.21. This means that the time to complete the work in week 7 progresses with greater costs (cost underrun) while in week 16 there is a delay with costs incurred greater than planned (cost overrun).

The values of Cost Variance (CV) and Schedule Variance (SV) and the relationship between the two values can be seen from table 5 and figure 4 below.

Table 5. Recapitulation of Cost Variance (CV) and Schedule Variance (SV) Values

Week	Value	
	Cost Variance (CV) = EV - AC	**Schedule Variance (SV) = EV - PV**
1	Rp (590,220,592.80)	Rp 17,108,270.47
2	Rp (756,991,507.75)	Rp 89,181,301.72
3	Rp (522,329,887.68)	Rp 407,721,102.68
4	Rp (531,861,471.67)	Rp 302,575,347.78
5	Rp (448,643,621.67)	Rp 516,026,742.42
6	Rp (868,439,352.55)	Rp 416,254,811.99
7	Rp (954,529,639.70)	Rp 90,836,984.97
8	Rp (891,585,202.81)	Rp (44,423,068.63)
9	Rp (895,469,427.80)	Rp (160,633,204.89)
10	Rp (997,828,166.51)	Rp (403,923,735.31)
11	Rp (1,165,963,942.04)	Rp (539,435,302.71)
12	Rp (1,029,801,694.81)	Rp (192,881,824.34)
13	Rp (892,480,102.58)	Rp (418,281,964.94)
14	Rp (811,232,958.28)	Rp (545,136,980.49)
15	Rp (581,758,006.52)	Rp (731,933,898.02)
16	Rp (1,131,997,724.61)	Rp (1,056,645,008.21)

Source: Analysis Results

Figure 4. Graph of Value Relationship Cost Variance (CV) and Schedule Variance (SV)

Source: Analysis Results

3) *Performance Index Analysis*

The performance index analysis consists of the Cost Performance Index (CPI) and Schedule Performance Index (SPI) values with examples of calculations in week 7 and week 16, which are as follows:

a. Cost Performance Index (CPI) Value

General formula CPI = EV/AC

Week 7

CPI = Rp. 1,670,938,880.30 / Rp. 2,625,468,520.00
= 0.636

Week 16

CPI = Rp. 4,629,172,486.21/Rp. 5,761,170,210.82
= 0.804

b. Schedule Performance Index (SPI) Value

General formula SPI = EV / PV

Week 7

SPI = Rp. 1,670,938,880.30 / Rp. 1,580,101,895.34
= 1,057

Week 16

SPI = Rp. 4,629,172,486.21 / Rp. 1,580,101,895.34
= 0.814

From the results of the calculation above in week 7, the Cost Performance Index (CPI) value was less than one or (CPI < 1) which was 0.636 and the schedule Performnce Index (SPI) value was greater than one or (SPI > 1) which was 1.057, meaning that the project performance progressed with costs incurred greater than the plan or cost overrun while in week 16 the CPI value was less than one or (CPI < 1) which was 0.804 and the SPI value was less than one or (SPI < 1) which is 0.814 which means that the project performance is delayed with greater costs incurred or schedule underrun.

The results of the calculation and graph of the relationship between the CPI and SPI values can be seen from table 6 and figure 5 below.

Table 6. Recapitulation of Schedule Performance Index (SPI) and Cost Performance Index (CPI) Values

Week	Value			
	Schedule Performance Index (SPI) = EV/PV		Cost Performance Index (CPI) = EV / AC	
	Per Week	Cumulative	Per Week	Cumulative
1	8.161	8.161	0.032	0.032
2	1.666	9.827	0.228	0.260
3	2.682	12.510	0.554	0.814
4	1.602	14.112	0.602	1.416
5	1.603	15.715	0.754	2.170
6	1.348	17.063	0.650	2.820
7	1.057	18.121	0.636	3.456
8	0.977	19.098	0.680	4.135
9	0.929	20.027	0.701	4.837
10	0.853	20.880	0.701	5.538

Week	Value			
	Schedule Performance Index (SPI) = EV/PV		Cost Performance Index (CPI) = EV / AC	
	Per Week	Cumulative	Per Week	Cumulative
11	0.831	21.711	0.695	6.233
12	0.947	22.658	0.772	7.005
13	0.899	23.557	0.807	7.812
14	0.882	24.439	0.834	8.645
15	0.857	25.297	0.883	9.528
16	0.814	26.111	0.804	10.332

Data Source: Analysis Results

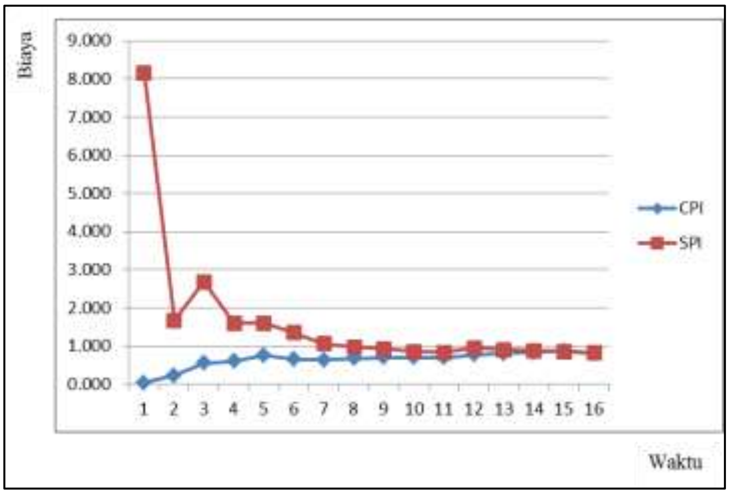

Figure 5. Value Relationship Chart (CPI) and (SPI)
Source: Analysis Results

4) Analysis of Project Estimated Cost and Final Completion Time Calculation

To determine the estimated final cost of the project or Estimate At Completion (EAC) and the final completion time of the project or Time Estimate (TE) in the analysis and calculated as follows:

a. Calculation of the estimated final cost of the project or Eastimate At Completion (EAC).

For the calculation of the estimated final cost of the project or Estimate At Completion (EAC) is calculated in several approaches or alternatives as seen in the description below:

Alternative 1, The performance of the project is considered to be in accordance with the current conditions. In alternative 1, the value of Estimate To Complete (ETC) is first determined assuming the value of realization of project progress is greater than 50%, then the formula of ETC = (BAC – EV) / CPI and the EAC formula =AC + ETC.

Examples of calculations taken in week 7 and week 16 are as follows:

Week 7

ETC = (Rp. 8,464,200,000.00 - Rp. 1,670,938,880.30) / 0.636
= Rp. 10,673,935,132.10

Then the value of:

EAC =AC+ETC
= Rp. 2,625,468,520.00 + Rp. 10,673,935,132.10
= Rp. 13,299,403,652.01

Week 16

ETC = (Rp. 8,464,200,000.00 - Rp. 4,629,172,486.21) / 0.804
= Rp. 4,772,828,477.65

Then the value of:

EAC =AC+ETC
= Rp. 5,761,170,210.82 + Rp. 4,772,828,477.65
= Rp. 10,533,998,688.47

The overall value of Estimate To Complete (ETC) and Estimate at Completion (EAC) can be seen in the table. 7

Alternative 2, If the rest of the work can be completed according to the budget plan.

General Formula EAC = AC+ (BAC – EV)

Week 7

EAC = Rp. 2,625,468,590.00 + (Rp. 8,464,200,000.00 - Rp1,670,938,880.30
= Rp. 9,418,729,639.70

Week 16

EAC = (Rp. 5,761,170,210.82 + (Rp. 8,464,200,000.00 -Rp. 4,629,172,486.21
= Rp. 9,596.197.724.61

The overall value of Estimate To Complete (ETC) and Estimate at Completion (EAC) can be seen in table 7.

Alternative 3, If the rest of the work is expected to be completed based on current conditions.

General Formula EAC = BAC/Cumulative CPI

Week 7

EAC = Rp. 8,464,200,000.00 / 3,456
= IDR 2,449,156,428.43

Week 16

EAC = Rp. 8,464,200,000.00 / 10,332
= Rp. 819,222,209.48

The overall value of Estimate To Complete (ETC) and Estimate at Completion (EAC) can be seen in table 7.

Alternative 4, If the remaining jobs are forecast based on the current combined conditions of SPI and CPI.

General Formula of EAC= AC+{(BAC-EV) / (Cumulative CPI x Cumulative SPI)}

Week 7

EAC = Rp. 2,625,468,520.00 + {(Rp. 8,464,200,000.00 - Rp. 1,670,938,880.30) / (3,456x 18,121)}
= Rp. 2,733,944,770.97

Week 16

EAC = Rp. 5,761,170,210.82 + {(Rp. 8,464,200,000.00 - Rp. 4,629,172,486.21) / (10,332 x26,111)}
= Rp. 5,775,385,762.25

The Estimate To Completion (ETC), Estimate At Completion (EAC) and histogram chart values of the EAC can be seen in table 7 and figure 6 to figure 9 below.

Table 7. Recapitulation of Estimate To Completion (ETC) and Estimate At Completion (EAC) Values

Week	Value				
	Estimate To Complete (ETC)	Estimate at Completion (EAC)			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
	ETC=(BAC-EV)/CPI	EAC= AC + ETC	EAC= AC + (BAC - EV)	EAC = BAC / Cumulative CPI x Cumulative SPI	EAC = AC + {(BAC - EV) (Cumulative CPI) (Cumulative SPI)}
1	Rp 264,080,609,337.60	Rp 264,690,327,337.60	Rp 9,054,420,592.80	Rp 264,690,327,337.60	Rp 93,966,152,695.21
2	Rp 32,621,526,488.67	Rp 33,719,302,458.67	Rp 9,211,915,507.75	Rp 33,023,414,694.65	Rp 4,231,415,385.79
3	Rp 14,092,914,630.10	Rp 15,265,301,650.10	Rp 8,986,529,887.68	Rp 10,308,134,999.97	Rp 1,928,754,688.05
4	Rp 12,779,512,666.91	Rp 14,057,261,086.91	Rp 8,996,061,471.67	Rp 5,976,972,001.62	Rp 1,720,009,277.25
5	Rp 9,441,382,603.35	Rp 11,322,014,573.35	Rp 8,912,843,621.67	Rp 3,901,065,586.48	Rp 2,028,635,050.98
6	Rp 10,545,535,972.90	Rp 13,025,499,492.90	Rp 9,332,639,352.55	Rp 3,003,958,736.06	Rp 2,692,400,681.50
7	Rp 10,673,955,132.01	Rp 13,299,403,652.01	Rp 9,418,729,639.70	Rp 2,445,156,628.45	Rp 2,733,944,770.97
8	Rp 9,654,612,072.33	Rp 12,456,482,392.33	Rp 9,535,785,202.81	Rp 2,046,733,849.20	Rp 2,985,196,686.59
9	Rp 9,071,135,728.04	Rp 12,069,126,048.04	Rp 9,359,669,427.80	Rp 1,749,966,986.97	Rp 3,063,666,159.01
10	Rp 8,728,622,777.19	Rp 12,069,240,833.55	Rp 9,462,028,166.51	Rp 1,528,345,512.36	Rp 3,393,546,263.16
11	Rp 8,355,935,736.39	Rp 12,180,755,893.06	Rp 9,630,163,942.04	Rp 1,357,923,662.47	Rp 3,864,289,469.28
12	Rp 6,458,618,053.64	Rp 10,968,714,305.46	Rp 9,494,001,694.81	Rp 1,208,372,067.95	Rp 4,541,498,223.27
13	Rp 5,867,566,206.28	Rp 10,489,580,358.10	Rp 9,356,680,102.58	Rp 1,083,549,960.23	Rp 4,847,942,104.97
14	Rp 5,273,459,716.28	Rp 10,152,284,377.10	Rp 9,275,433,958.28	Rp 979,857,473.21	Rp 4,905,643,463.06
15	Rp 4,602,036,276.81	Rp 9,583,414,436.83	Rp 9,045,928,006.52	Rp 888,305,119.41	Rp 4,998,258,929.97
16	Rp 4,772,828,477.63	Rp 10,533,998,688.47	Rp 9,596,197,724.61	Rp 819,222,209.48	Rp 5,775,385,762.25

Source: Analysis Results

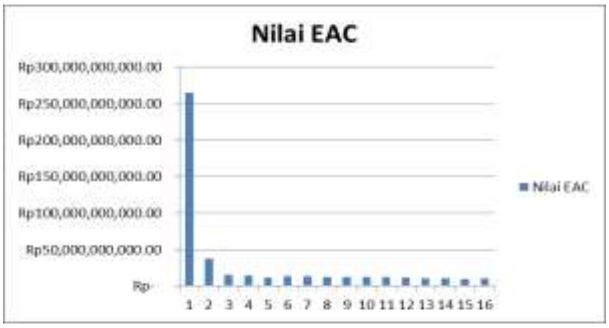

Figure 6. Alternative Histogram Chart (EAC) 1

Data Source: Analysis Results

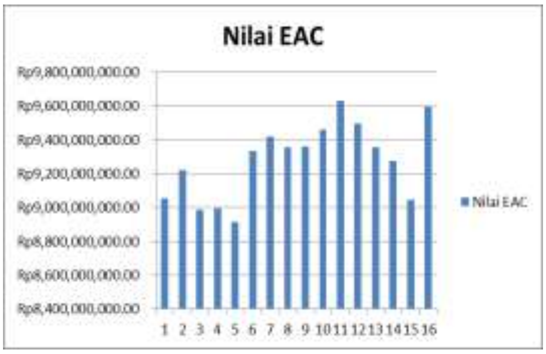

Figure 7. Alternative Value Histogram Chart (EAC) 2

Data Source: Analysis Results

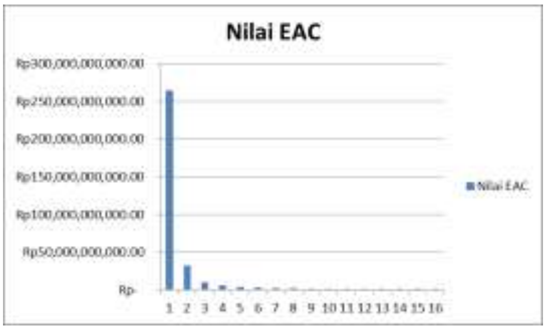

Figure 8. Alternative Value Histogram Chart (EAC) 3

Data Source: Analysis Results

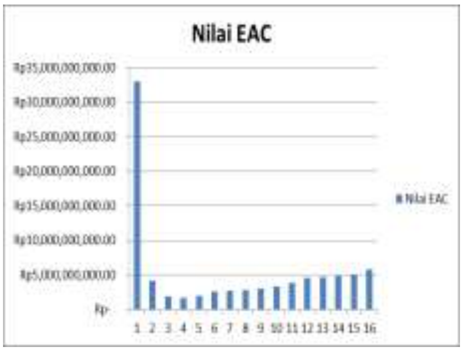

Figure 9. Alternative Histogram Value Chart (EAC) 4

Data Source: Analysis Results

From the EAC value above, the Index At Completion (IAC) value of each alternative can be calculated and determined, namely with the equation: IAC = (EAC/BAC)

Alternative 1

Week 7

IAC = Rp. 13,299,403,652.01 / Rp. 8,464,200,000.00
= 1,571

Week 16

IAC = Rp. 10,533,998,688.47 / Rp. 8,464,200,000.00
= 1,245

Alternative 2

Week 7

IAC = Rp. 9,418,729,639.70 / Rp. 8,464,200,000.00
= 1.113

Week 16

IAC = Rp. 9,596,197,724.61 / Rp. 8,464,200,000.00
= 1.134

Alternative 3

Week 7

IAC = Rp. 2,449,156,428.43 / Rp. 8,464,200,000.00
= 0.289

Week 16

IAC = Rp. 819,222,209.48 / Rp. 8,464,200,000.00
= 0.097

Alternative 4

Week 7

IAC = Rp. 2,733,944,770.97 / Rp. 8,464,200,000.00
= 0.323

Week 16

IAC = Rp. 5,775,385,762.25 / Rp. 8,464,200,000.00
= 0.682

The results of the calculation of the Index At Completion (IAC) value and graph can be seen in table 8 below:

Table 8. Nilai Index At Completion (IAC)

Week	Alternative 1 IAC = EAC / BAC	Alternative 2 IAC = EAC / BAC	Alternative 3 IAC = EAC / BAC	Alternative 4 IAC = EAC / BAC
1	31.272	1.070	31.272	3.895
2	4.394	1.089	3.853	0.498
3	1.804	1.062	1.228	0.229
4	1.661	1.063	0.706	0.203
5	1.327	1.053	0.461	0.240
6	1.539	1.103	0.355	0.310
7	1.571	1.113	0.289	0.323
8	1.472	1.105	0.242	0.338
9	1.426	1.106	0.207	0.362
10	1.426	1.118	0.181	0.401
11	1.439	1.138	0.160	0.457

Week	Alternative 1 IAC = EAC / BAC	Alternative 2 IAC = EAC / BAC	Alternative 3 IAC = EAC / BAC	Alternative 4 IAC = EAC / BAC
12	1.296	1.122	0.143	0.537
13	1.239	1.105	0.128	0.549
14	1.199	1.096	0.116	0.579
15	1.132	1.069	0.105	0.591
16	1.245	1.134	0.097	0.682

Data Source: Analysis Results

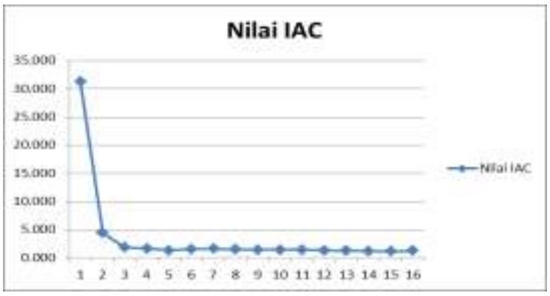

Figure 10. Alternative IAC Value Chart 1
Data Source: Analysis Results

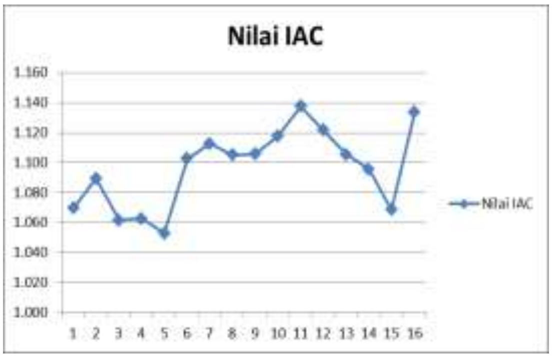

Figure 11. Alternative IAC Value Chart 2
Data Source: Analysis Results

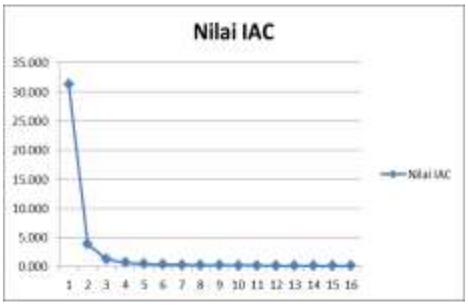

Figure 12. Alternative IAC Value Chart 3
Data Source: Analysis Results

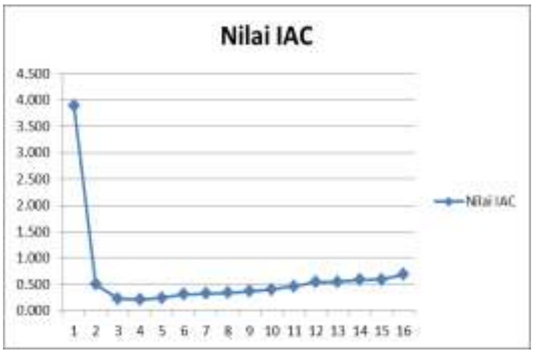

Figure 13. Alternative IAC Value Chart 4
Data Source: Analysis Results

b. Calculation of Project Final Completion Time or Time Estimate (TE)

The estimated project end time (TE) is calculated using the equation TE = ATE +[OD – (ATE x SPI)] / SPI, which is as follows:

At the 7th week review

TE = 7 + {26 – (7 x 1.057)} / 1.057
= 24,587 weeks or
= 25 weeks

At the 16th week review

TE = 16 + {26 – (16 x 0.814)]}/ 0.814
= 31,941 weeks or
= 32 weeks

The results of the calculation of the final estimated time of the project can be seen in table 9.

Table 9. Estimated Time Estimate (TE)

Week	Time Estimate (TE)
	TE=ATE + [(OD - (ATE x SPI))/SPI]
1	3.186
2	15.603
3	9.693
4	16.226
5	16.221
6	19.284
7	24.587
8	26.611
9	27.986
10	30.483
11	31.282
12	27.441
13	28.916
14	29.485
15	30.325
16	31.935

Data Source: Analysis Results

Analysis and Discussion of Conventional Cost Management Methods and Earned Value Method

From the two methods that have been calculated and analyzed, both the Conventional Cost Management Method and the Earned Value Method reveal a clear evolution in project performance between weeks 7 and 16. Initially, at week 7, the Conventional Method showed the project as ahead of schedule but over budget, with actual costs exceeding the plan. In contrast, the Earned Value Method (EVM) provided a more nuanced diagnosis at this same point: while the Schedule Performance Index (SPI) of 1.057 confirmed the project was ahead of schedule, the Cost Performance Index (CPI) of 0.636 signaled a significant cost overrun, predicting a final completion time of 25 weeks.

By week 16, the situation had deteriorated. Both methods then indicated the project was behind schedule. The Conventional Method showed costs were now below plan, typically a sign of slowed progress. The EVM metrics confirmed this, with the SPI dropping to 0.814 (schedule overrun) and the CPI at 0.804 (cost overrun), leading to a revised, delayed completion estimate of 32 weeks. Crucially, the comparative analysis highlights EVM's superior diagnostic capability, as it integrates cost and schedule data using three indicators (BCWS, BCWP, ACWP) to enable forecasting of final costs and completion dates, which the Conventional Method cannot provide.

CONCLUSION

The analysis of the ROW 46 Segment II Road and Main Channel Works Project in Jakarta Garden City revealed that the Conventional Cost Management method, which only compares planned and actual costs, lacks the ability to predict future project developments, whereas the Earned Value Method provides a more accurate assessment of cost and time performance for each period. Findings showed that by week 7, the project was ahead of schedule (schedule underrun) but incurred higher costs than planned (cost overrun), and by week 16, delays occurred (schedule overrun) with costs still exceeding the plan. Using indicators like SPI, CPI, and forecasts such as EAC and TE, the Earned Value Method proved more effective in monitoring and predicting project performance, enabling timelier corrective actions like adding labor or rescheduling. Future research should explore the integration of Earned Value Method with risk management and real-time data analytics to further enhance predictive accuracy and responsiveness in complex construction projects.

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