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Earned Value Analysis on the Tayan Bulking Station Project in East Kalimantan

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Abstract: This study aims to analyze the cost and schedule performance and to estimate the final cost and completion time of the Tayan Bulking Station Project in West Kalimantan. The method used is Earned Value Analysis (EVA) by analyzing three main parameters: Budgeted Cost of Work Scheduled (BCWS), Budgeted Cost of Work Performed (BCWP), and Actual Cost of Work Performed (ACWP). Secondary data was obtained from PT. Sarana Remaja Mandiri, including the budget plan, S-curves, and weekly progress reports up to the 23rd week. The analysis continued by calculating variances (SV, CV), performance indices (SPI, CPI), and final estimates (EAC, ETC, ETS, EAS). The results indicate that the project's cost performance fluctuated. In the early project stages (weeks 1-9), there was a cost overrun (CPI < 1). However, in the subsequent period (weeks 10-23), cost performance improved significantly with cost efficiency (CPI > 1, reaching 2.35). Overall, the estimated final cost (EAC) is IDR 34.99 billion, which aligns with the initial budget (BAC). On the other hand, schedule performance tended to be delayed (SPI < 1) for most of the observation periods (weeks 1-14 & 18-23), although there was acceleration in weeks 15-17. The estimated project completion time (EAS) is 35 weeks, indicating a 1-week delay from the planned schedule of 34 weeks. The Earned Value method proved effective in identifying project performance. It is concluded that the Tayan Bulking Station Project is efficient in terms of cost but inefficient in terms of time, with a final delay of one week. This study recommends a greater focus on schedule control and improvement for this project and similar future projects.

Keywords: Earned Value Analysis Using Project Time and Costs

INTRODUCTION

Construction projects are endeavors that require planning with various resources and funds to achieve future benefits. In construction projects, resources include minerals, labor, funds, implementation methods, and equipment. These resources are designed to achieve project objectives within time, cost, and quality constraints. However, in practice, construction projects often encounter cost and time delays, leading to delays in task completion. As a result, completion times do not meet established plans. Therefore, construction management is essential in construction project implementation (Styaningrum, 2022).

This study analyzes project cost and time control, as well as estimating costs and time expenditures relative to plans, to determine whether the project is experiencing delays. The

author then utilizes the earned value method to analyze factors related to project cost and time. The earned value method is one technique applied in project control regarding time and cost. The purpose of this concept is to control the project and identify increasingly detailed performance indicators, costs, and implementation time in an analysis. This method is an important approach in project management that integrates cost and time aspects. Therefore, the Earned Value method is highly relevant for analyzing cost and time deviations in projects with performance information over a specific timeframe. (al., 2024).

The project reviewed in this study is the construction of the Tayan Bulking Station located in Sanggau Regency, West Kalimantan Province, Indonesia. This project is a tank farm bulking station, consisting of several large storage tanks used to store various liquids, particularly fuel oil and chemicals. PT. SRM (Sarana Remaja Mandiri) is one of the companies responsible for implementing this project. This company is a national private company engaged in engineering, steel fabrication, and construction services in the civil and mechanical fields. The contract for the Tayan Bulking Station project stipulates a budget of IDR 34,990,000,000 (thirty-four billion nine hundred and ninety million rupiah), which includes production costs and construction and installation costs.

This research aims to explore the following issues:

1. How does the project perform based on the project implementation planning timeline?
2. How does the project perform based on the project planning costs?
3. What are the estimated costs and time required to complete the project?

Based on the problem formulation previously stated, the objectives of this study are to determine how Earned Value Management is applied in the Tayan Bulking Station project in West Kalimantan.

1. To analyze project performance based on project implementation time.
2. To analyze project performance based on project implementation costs.
3. To analyze the estimated project costs and time required to complete the project.

Based on the description above, it can be concluded that the main issues analyzed are limited to the Earned Value method:

1. Analysis of the planned time calculation in accordance with the actual time performance.
2. Focus on calculating the actual cost of project performance in accordance with the initial project plan.
3. This research includes the results of the estimated costs and time required to complete the project.

There are several benefits from this research, including:

1. Increasing knowledge about construction management, particularly regarding project schedules and costs.
2. Can be used as reading material or a reference for similar research.
3. As an initial step in project evaluation through measuring ongoing project performance.

LITERATUR REVIEW

Previous Research

The author has utilized previous research findings as a basis or reference for this study, allowing for refinement of the theory applied in future studies. Several of the studies below relate to the Earned Value method used by the author.

1. Researchers and Year : Reza Rahmattulla h, Masca Indra Triana (2024). Research Title : Evaluation of Time and Cost Using the Earned Value Analysis Method on the Talun Community Health Center Development Project in Blitar Regency, Method : earned value, research result : Schedule Variance (SV) for week 13: Rp - 165,313,862.5 → BCWP <BCWS (work delays), Cost Variance (CV) week 13: Rp 286,761,471.2 → costs are lower than the value of work completed,SPI (Schedule Performance Index) week 13: 0.7 → significant delay, Consumer Price Index (CPI) week 13: 3.64 → Cost efficiency did not meet budget targets.
2. Researchers and Year : Dimas Gusti Wiranegara, Gede Sarya, Masca Indra Triana (2024), Research Title : Earned Value Analysis Regarding Cost and Time in the Production Warehouse Construction Project PP. Method : Earned Value Analysist. Research Result : CV (Cost Variance) week 16: Rp 1,995,516,896 → no excess costs SV (Schedule Variance) week 16: Rp - 162,490,873 → schedule not according to plan. SPI (Schedule Performance Index) Week 16: 0.994 (<1)

Project

A project is a temporary endeavor or business from the time the work is initially established (Adhicandra, 2023). Although temporary in its implementation, the results of a project can have a long-term impact on the company. Projects are characterized by: having specific goals and needs, having time and scope limitations, being implemented in a planned, coordinated, and controlled manner, and managing three main aspects: time, cost, and resources.

A project is an organized effort or activity to achieve goals and objectives using a budget and resources that must be completed within a specific timeframe. For a project to achieve its intended goals and objectives, good management is required (Yunus, 2023).

Project Management

Project management is the art and science of leading an organization, encompassing the planning, implementation, and control of projects with limited resources in an effort to achieve goals and objectives effectively and efficiently (Siswanto, 2020). Project management is the process of combining tools, resources, and techniques to achieve predetermined objectives. Project management activities include planning, organization, implementation, and control.

Project management involves managing all aspects of a project, including planning, organizing, implementing, and controlling. The project manager is responsible for overseeing and managing the entire process, from initial concept to project completion.

Project management consists of several phases: planning, organizing, implementing, monitoring, and closing. Project management requires project managers to possess adequate skills and knowledge of project management, time and cost management techniques, risk management, and the ability to lead and manage project teams.

Construction Management

Construction management is the process by which the project manager effectively manages the resources involved in a construction project. Resources in a construction project can be grouped into manpower, materials, machines, money, and methods. Civil engineering projects have distinct characteristics compared to other industries (Ervianto, 2023).

Earned Value Analysis

Earned Value Management (EVM) is a methodology for measuring and communicating the progress of a project's performance. The important variables in this methodology are time (schedule), cost, and work. The goal of this methodology is an efficient project, which means completing work within the specified time while minimizing costs or materials spent on the project. This goal is expected to be achieved by evaluating and controlling project risks by measuring progress periodically (Wahyuni, 2020).

The concept of Earned Value can be used to analyze performance and make predictions about target achievement. For this purpose, three indicators are used, namely:

1. Budgeted Cost of Work Scheduled (BCWS)

This is similar to a budget for a work package, but is structured and linked to an implementation schedule. This combines cost, schedule, and scope of work, with each work element assigned a cost allocation and schedule that can serve as benchmarks for work implementation. The formula used is:

$$BCWS = \frac{Budget\ Commulative\ Plan\ \%}{100\%} \times BAC \quad \text{.....1}$$

2. Budgeted Cost of Work Performed (BCWP)

This indicator shows the value of the work completed relative to the budget allocated for that work. When the ACWP figure is compared to the BCWP, the costs incurred for the work performed are compared to the costs that should have been incurred for that purpose. The equation used is:

$$BCWP = \frac{Bobot\ Commulative\ Actual\ \%}{100\%} \times BAC \quad \text{.....2}$$

3. Actual Cost of Work Performed (ACWP)

This is the actual cost of the work performed. This cost is derived from the project's accounting or financial data as of the reporting date, namely records of actual cost expenditures for work packages or accounting codes, including overhead calculations, etc. Therefore, ACWP is the actual amount of expenditures or funds used in the work over a specific time period.

The resulting variances are called the integrated cost variance (CV) and the integrated schedule variance (SV). SV is used to determine whether the project is on schedule. The

schedule variance is the difference between the BCWP and BCWS. Meanwhile, the CV is used to determine whether an ongoing project is within budget or exceeding its planned budget. The cost variance is the difference between the BCWP and ACWP. The cost and schedule variance formulas are as follows:

$$CV = BCWP - ACWP \quad \text{.....3}$$

$$SV = BCWP - BCWS \quad \text{.....4}$$

Project managers often want to know the efficiency of resource use. This is expressed as a productivity index or performance index, such as the Cost Performance Index (CPI) and the Schedule Performance Index (SPI).

1. Cost Performance Index (CPI)

The efficiency factor of costs incurred can be demonstrated by comparing the value of work physically completed (BCWP) with the costs incurred during the same period (ACWP). The CPI value indicates the weight of the value obtained (relative to the overall project value) against the contractor's costs. If the CPI is less than 1, this indicates poor performance, because the costs incurred or ACWP are greater than the value obtained or BCWP, resulting in wasted costs. To calculate the CPI, the following formula is used:

$$CPI = \frac{BCWP}{ACWP} \quad \text{.....5}$$

2. *Schedule Performance Index* (SPI)

The worker efficiency factor in completing work can be observed by using a comparison between the value of work that has been physically completed or BCWP with the planned expenditure costs incurred based on the work plan or BCWS. The SPI value indicates how much work can be completed (relative to the overall project) against the planned work units. An SPI value of less than 1 indicates that work control is not in accordance with expectations because it is unable to achieve the project work targets that were planned from the start. To calculate the SPI, it is calculated using the formula:

$$SPI = \frac{BCWP}{BCWS} \quad \text{.....6}$$

3. Estimate to Complete (ETC)

Estimate to Complete (ETC) is an estimate of the cost of remaining work, assuming that the project's control trend will remain unchanged until the end of the project. The formula used is:

$$ETC = BAC - EAC \quad \text{.....7}$$

From the ETC calculation, several methods can be produced, namely:

If the work percentage is below 50%, then the formula is:

$$ETC = (BAC - BCWP) \quad \text{.....8}$$

If the work percentage is above 50%, then the formula is :

$$ETC = \frac{BAC - BCWP}{CPI} \quad \text{.....9}$$

4. Estimate at Completion (EAC)

The Estimate at Completion (EAC) is an estimate of the total costs incurred from the start of work to the end of the project, derived from actual costs plus the ETC. At the end of the project implementation week, the ETC value is the same as the ACWP value that occurred during that week.

$$EAC = ACWP + ETC \quad \text{.....10}$$

5. Estimated Temporary Schedule (ETS)

The Estimated Temporary Schedule (ETS) is an estimate of the time required for the remaining work.

$$ETS = \frac{remaining\ time}{SCHEDULE\ PERFORMANCE\ INDEX\ (\ SPI\ )} \quad \text{.....11}$$

6. Estimate as Schedule (EAS)

Estimate as Schedule (EAS) is the estimated total project completion time calculated based on the completed time plus the ETS results.

$$EAS = Time\ Employed + ETS \quad \text{.....12}$$

RESEARCH METHOD

Problem Identification

Problem identification aims to identify existing problems at the research site so that these problems can be clearly formulated. The research questions will include analyzing the calculation of planned time versus actual time performance and analyzing the calculation of project performance costs based on the initial project plan.

Literature Review

This stage is the process of collecting information and data from journals, books, papers, and various internet sources regarding theories on construction project time and cost management using the Earned Value method.

Data Collection

In this study, the author used secondary data. The secondary data was obtained directly from the company (PT Sarana Remaja Mandiri), which is responsible for the project. The data obtained are as follows:

1. RAB (Cost Budget Plan)

   This is a project document that details all costs incurred to complete all work on a project. The RAB includes the costs of materials, labor, equipment, and other costs related to the project.

2. S-Curve (Planned and Actual)

   The S-Curve is a graph that shows the relationship between the amount of time required to complete a task and the total amount of work progress, with the progress representing the price of the work. The S-Curve illustrates the progress of the amount of work performed during the project. By comparing the work progress curve with the curve determined by the plan, it is easy to understand or detect any delays. The S-Curve progress is created by considering integration to check for work-related deviations. Weekly and Monthly Project Progress Weekly and monthly project progress are records that document the progress of project work over a specific time period (weekly and monthly).

3. Project Expenditure Report

   This is a document that documents all related expenses, both direct and indirect. This report serves to track and control project costs, ensure expenditures are in

accordance with the established budget, and assist in making project financial decisions.

RESULT AND DISCUSSION

Data Analysis

After obtaining the project data, the next step is data processing. This begins with analyzing project performance by calculating three indicators: BCWS, BCWP, and ACWP. All of this data is processed in tabular form, and the calculations are performed using Microsoft Excel 2010.

1. BCWS (Budgeted cost of work scheduled)

   The BCWS calculation is obtained by multiplying the weekly Cumulative Plan weight by the BAC (budgeted at completion), which is the contract value from the previous agreement on a project. The BCWS value is a form of the Project Time Schedule Planning / "S" Curve.

   Example of BCWS calculation in the first week

   BCWS Week 1 = (% Plan) × (Budget)

   = 0.45% × 34,990,000,000

   = 157,008,608.11

Table 1. BCWS Data Calculation Analysis

Month	Week To	Progress Plan	Commulative Plan	Contract Value	BCWS	Commulative BCWS
February	1	0.45%	0.45%	34,990,000,000	157,008,680.11	157,008,680.11
March	2	0.45%	0.90%	34,990,000,000	157,008,680.11	314,017,360.22
	3	0.45%	1.35%	34,990,000,000	157,008,680.11	471,026,040.32
	4	0.15%	1.49%	34,990,000,000	51,510,119.65	522,536,159.97
	5	0.15%	1.64%	34,990,000,000	51,510,119.65	574,046,279.62
April	6	0.00%	1.64%	34,990,000,000	-	574,046,279.62
	7	0.00%	1.64%	34,990,000,000	-	574,046,279.62
	8	1.54%	3.18%	34,990,000,000	538,198,309.14	1,112,244,588.76
	9	1.54%	4.72%	34,990,000,000	538,198,309.14	1,650,442,897.91
	10	1.43%	6.14%	34,990,000,000	499,627,406.88	2,150,070,304.78
May	11	1.43%	7.57%	34,990,000,000	499,627,406.88	2,649,697,711.66
	12	1.43%	9.00%	34,990,000,000	499,627,406.88	3,149,325,118.53
	13	1.69%	10.69%	34,990,000,000	589,920,588.32	3,739,245,706.85
	14	2.46%	13.15%	34,990,000,000	862,104,885.96	4,601,350,592.81
June	15	3.14%	16.29%	34,990,000,000	1,097,300,468.35	5,698,651,061.16
	16	3.76%	20.05%	34,990,000,000	1,315,796,056.37	7,014,447,117.53
	17	3.76%	23.81%	34,990,000,000	1,315,796,056.37	8,330,243,173.90
	18	7.96%	31.77%	34,990,000,000	2,786,371,376.74	11,116,614,550.65
July	19	7.96%	39.73%	34,990,000,000	2,786,371,376.74	13,902,985,927.39
	20	7.96%	47.70%	34,990,000,000	2,786,371,376.74	16,689,357,304.14

Month	Week To	Progress Plan	Commulative Plan	Contract Value	BCWS	Commulative BCWS
	21	7.96%	55.66%	34,990,000,000	2,786,371,376.74	19,475,728,680.88
	22	7.95%	63.61%	34,990,000,000	2,780,448,441.87	22,256,177,122.75
	23	7.73%	71.34%	34,990,000,000	2,705,536,349.10	24,961,713,471.85

(*Source: Research Processed, 2025*)

2. BCWP (Budget Cost Of Work Performed)
   The BCWP calculation is obtained from the percentage of the actual cumulative weight each week multiplied by the BAC (Budgeted at Completion). The actual cumulative weight each week is obtained from the Weekly Progress Project.
   Example of BCWP calculation in week 3
   BCWP Week 3 = (% Actual) × (Budget)
   = 0.05% × 34,990,000,000
   = 17,495,000

Table 2. BCWP Calculation Data Analysis

Month	Week To	Progres Actual	Commulative Actual	Contract Value	BCWP	BCWP Commulative
Februari	1	0.00%	0.00%	34,990,000,000	-	-
March	2	0.00%	0.00%	34,990,000,000	-	-
	3	0.05%	0.05%	34,990,000,000	17,495,000.00	17,495,000.00
	4	0.05%	0.10%	34,990,000,000	17,495,000.00	34,990,000.00
	5	0.68%	0.78%	34,990,000,000	239,415,749.82	274,405,749.82
April	6	0.00%	0.78%	34,990,000,000	-	274,405,749.82
	7	0.15%	0.94%	34,990,000,000	53,832,701.00	328,238,450.82
	8	0.49%	1.43%	34,990,000,000	171,600,078.92	499,838,529.74
	9	1.87%	3.30%	34,990,000,000	654,657,826.11	1,154,496,355.84
	10	1.34%	4.64%	34,990,000,000	468,472,875.43	1,622,969,231.27
May	11	1.70%	6.34%	34,990,000,000	593,860,838.42	2,216,830,069.69
	12	1.34%	7.67%	34,990,000,000	468,482,406.51	2,685,312,476.20
	13	3.01%	10.68%	34,990,000,000	1,053,347,622.69	3,738,660,098.89
	14	1.00%	11.69%	34,990,000,000	351,219,070.54	4,089,879,169.42
June	15	6.19%	17.88%	34,990,000,000	2,166,504,598.45	6,256,383,767.88
	16	4.53%	22.42%	34,990,000,000	1,586,790,084.86	7,843,173,852.74
	17	3.48%	25.89%	34,990,000,000	1,216,274,254.02	9,059,448,106.76
	18	4.97%	30.86%	34,990,000,000	1,738,095,463.61	10,797,543,570.37
July	19	6.32%	37.18%	34,990,000,000	2,210,630,807.88	13,008,174,378.25
	20	4.23%	41.41%	34,990,000,000	1,481,391,585.84	14,489,565,964.09
	21	6.20%	47.61%	34,990,000,000	2,168,954,580.91	16,658,520,545.00
	22	7.34%	54.95%	34,990,000,000	2,567,702,498.60	19,226,223,043.60
	23	7.83%	62.78%	34,990,000,000	2,739,640,569.17	21,965,863,612.77

(*Source: Research Processed, 2025*)

3. ACWP (Actual Cost Work Performanced)
   The actual cost of the work performed. This cost is derived from the project's accounting or financial data as of the reporting date, namely records of actual cost expenditures from work packages or accounting codes, including overhead

calculations, etc. Therefore, ACWP is the actual amount of expenditure or funds used in the work over a specific period.

Table 3. ACWP Calculation Data Analysis

Month	Week To	ACWP	ACWP Commulative
February	1	166,723,342.00	166,723,342.00
March	2	22,500,000.00	189,223,342.00
	3	74,400,000.00	263,623,342.00
	4	27,930,000.00	291,553,342.00
	5	132,115,760.00	423,669,102.00
April	6	-	423,669,102.00
	7	336,488,980.00	760,158,082.00
	8	153,338,170.00	913,496,252.00
	9	305,938,250.00	1,219,434,502.00
	10	111,947,000.00	1,331,381,502.00
May	11	221,934,856.00	1,553,316,358.00
	12	64,894,488.00	1,618,210,846.00
	13	1,031,668,600.00	2,649,879,446.00
	14	571,792,895.00	3,221,672,341.00
June	15	912,941,180.00	4,134,613,521.00
	16	258,081,275.00	4,392,694,796.00
	17	938,043,240.00	5,330,738,036.00
	18	431,950,000.00	5,762,688,036.00
July	19	273,941,660.00	6,036,629,696.00
	20	520,009,240.00	6,556,638,936.00
	21	553,424,800.00	7,110,063,736.00
	22	1,523,098,875.00	8,633,162,611.00
	23	730,563,346.00	9,363,725,957.00

Table 4. ACWP Calculation Data Analysis

Month	Week To	BCWP Commulative	ACWP Commulative	Cv commulative
February	1	-	-	-
March	2	-	-	-
	3	17,495,000.00	17,495,000.00	-
	4	34,990,000.00	52,485,000.00	(17,495,000.00)
	5	274,405,749.82	326,890,749.82	(52,485,000.00)
April	6	274,405,749.82	601,296,499.65	(326,890,749.82)
	7	328,238,450.82	929,534,950.46	(601,296,499.65)
	8	499,838,529.74	1,429,373,480.20	(929,534,950.46)
	9	1,154,496,355.84	2,583,869,836.04	(1,429,373,480.20)
	10	1,622,969,231.27	4,206,839,067.31	(2,583,869,836.04)
May	11	2,216,830,069.69	6,423,669,137.00	(4,206,839,067.31)
	12	2,685,312,476.20	9,108,981,613.20	(6,423,669,137.00)
	13	3,738,660,098.89	12,847,641,712.09	(9,108,981,613.20)
	14	4,089,879,169.42	16,937,520,881.51	(12,847,641,712.09)
June	15	6,256,383,767.88	23,193,904,649.39	(16,937,520,881.51)
	16	7,843,173,852.74	31,037,078,502.13	(23,193,904,649.39)
	17	9,059,448,106.76	40,096,526,608.90	(31,037,078,502.13)
	18	10,797,543,570.37	50,894,070,179.27	(40,096,526,608.90)
July	19	13,008,174,378.25	63,902,244,557.52	(50,894,070,179.27)

Month	Week To	BCWP Commulative	ACWP Commulative	Cv commulative
	20	14,489,565,964.09	78,391,810,521.61	(63,902,244,557.52)
	21	16,658,520,545.00	95,050,331,066.61	(78,391,810,521.61)
	22	19,226,223,043.60	114,276,554,110.21	(95,050,331,066.61)
	23	21,965,863,612.77	136,242,417,722.98	(114,276,554,110.21)

(*Source: Research Processed, 2025*

Analysis Of Variance

The resulting variances are called the integrated cost variance (CV) and the integrated schedule variance (SV). The SV is used to determine whether the project is on schedule. The schedule variance is the difference between the BCWP and BCWS.

The CV is used to determine whether the project is on budget or over budget. The cost variance is the difference between the BCWP and ACWP. The formulas for cost and schedule variances are as follows:

CV = BCWP – ACWP, and SV = BCWP – BCWS

Table 4. Results of CV V

Month	Week To	BCWP Commulative	BCWS Commulative	SV Commulative
Februari	1	-	157,008,680.11	(157,008,680.11)
Maret	2	-	314,017,360.22	(314,017,360.22)
	3	17,495,000.00	471,026,040.32	(453,531,040.32)
	4	34,990,000.00	522,536,159.97	(487,546,159.97)
	5	274,405,749.82	574,046,279.62	(299,640,529.80)
April	6	274,405,749.82	574,046,279.62	(299,640,529.80)
	7	328,238,450.82	574,046,279.62	(245,807,828.80)
	8	499,838,529.74	1,112,244,588.76	(612,406,059.03)
	9	1,154,496,355.84	1,650,442,897.91	(495,946,542.06)
	10	1,622,969,231.27	2,150,070,304.78	(527,101,073.51)
Mei	11	2,216,830,069.69	2,649,697,711.66	(432,867,641.97)
	12	2,685,312,476.20	3,149,325,118.53	(464,012,642.33)
-	13	3,738,660,098.89	3,739,245,706.85	(585,607.97)
	14	4,089,879,169.42	4,601,350,592.81	(511,471,423.39)
Juni	15	6,256,383,767.88	5,698,651,061.16	557,732,706.72
	16	7,843,173,852.74	7,014,447,117.53	828,726,735.21
	17	9,059,448,106.76	8,330,243,173.90	729,204,932.86
	18	10,797,543,570.37	11,116,614,550.65	(319,070,980.27)
Juli	19	13,008,174,378.25	13,902,985,927.39	(894,811,549.14)
	20	14,489,565,964.09	16,689,357,304.14	(2,199,791,340.05)
	21	16,658,520,545.00	19,475,728,680.88	(2,817,208,135.88)
	22	19,226,223,043.60	22,256,177,122.75	(3,029,954,079.15)
	23	21,965,863,612.77	24,961,713,471.85	(2,995,849,859.07)

(*Source: Research Processed, 2025*)

Table 4. Results of CV Variance analysis

Month	Week To	BCWP Commulative	ACWP Commulative	Cv commulative
February	1	-	-	-
March	2	-	-	-
	3	17,495,000.00	17,495,000.00	-
	4	34,990,000.00	52,485,000.00	(17,495,000.00)
	5	274,405,749.82	326,890,749.82	(52,485,000.00)
April	6	274,405,749.82	601,296,499.65	(326,890,749.82)
	7	328,238,450.82	929,534,950.46	(601,296,499.65)
	8	499,838,529.74	1,429,373,480.20	(929,534,950.46)
	9	1,154,496,355.84	2,583,869,836.04	(1,429,373,480.20)
	10	1,622,969,231.27	4,206,839,067.31	(2,583,869,836.04)
May	11	2,216,830,069.69	6,423,669,137.00	(4,206,839,067.31)
	12	2,685,312,476.20	9,108,981,613.20	(6,423,669,137.00)
	13	3,738,660,098.89	12,847,641,712.09	(9,108,981,613.20)
	14	4,089,879,169.42	16,937,520,881.51	(12,847,641,712.09)
June	15	6,256,383,767.88	23,193,904,649.39	(16,937,520,881.51)
	16	7,843,173,852.74	31,037,078,502.13	(23,193,904,649.39)
	17	9,059,448,106.76	40,096,526,608.90	(31,037,078,502.13)
	18	10,797,543,570.37	50,894,070,179.27	(40,096,526,608.90)
July	19	13,008,174,378.25	63,902,244,557.52	(50,894,070,179.27)
	20	14,489,565,964.09	78,391,810,521.61	(63,902,244,557.52)
	21	16,658,520,545.00	95,050,331,066.61	(78,391,810,521.61)
	22	19,226,223,043.60	114,276,554,110.21	(95,050,331,066.61)
	23	21,965,863,612.77	136,242,417,722.98	(114,276,554,110.21)

(*Source: Research Processed, 2025*)

3.1. Performance Index Analysis

Performance index analysis is a method used in the Earned Value Management (EVM) system to assess the efficiency and effectiveness of project implementation based on a comparison between work plans, actual progress, and costs incurred.There are two main indices used in performance index analysis:

Table 5. Analysis of CPI

Month	Week To	BCWP COMMULATIVE	ACWP COMMULATIVE	CPI COMMULATIVE
February	1	-	166,723,342.00	-
March	2	-	189,223,342.00	-
	3	17,495,000.00	263,623,342.00	0.07
	4	34,990,000.00	291,553,342.00	0.12
	5	274,405,749.82	423,669,102.00	0.65
April	6	274,405,749.82	423,669,102.00	0.65
	7	328,238,450.82	760,158,082.00	0.43
	8	499,838,529.74	913,496,252.00	0.55
	9	1,154,496,355.84	1,219,434,502.00	0.95
	10	1,622,969,231.27	1,331,381,502.00	1.22
May	11	2,216,830,069.69	1,553,316,358.00	1.43

Month	Week To	BCWP COMMULATIVE	ACWP COMMULATIVE	CPI COMMULATIVE
	12	2,685,312,476.20	1,618,210,846.00	1.66
	13	3,738,660,098.89	2,649,879,446.00	1.41
	14	4,089,879,169.42	3,221,672,341.00	1.27
June	15	6,256,383,767.88	4,134,613,521.00	1.51
	16	7,843,173,852.74	4,392,694,796.00	1.79
	17	9,059,448,106.76	5,330,738,036.00	1.70
	18	10,797,543,570.37	5,762,688,036.00	1.87
July	19	13,008,174,378.25	6,036,629,696.00	2.15
	20	14,489,565,964.09	6,556,638,936.00	2.21
	21	16,658,520,545.00	7,110,063,736.00	2.34
	22	19,226,223,043.60	8,633,162,611.00	2.23
	23	21,965,863,612.77	9,363,725,957.00	2.35

(*Source: Research Processed, 2025*)

Month	Week To	BCWP COMMULATIVE	BCWS COMMULATIVE	SPI COMMULATIVE
February	1	-	157,008,680.11	-
March	2	-	314,017,360.22	-
	3	17,495,000.00	471,026,040.32	0.04
	4	34,990,000.00	522,536,159.97	0.07
	5	274,405,749.82	574,046,279.62	0.48
April	6	274,405,749.82	574,046,279.62	0.48
	7	328,238,450.82	574,046,279.62	0.57
	8	499,838,529.74	1,112,244,588.76	0.45
	9	1,154,496,355.84	1,650,442,897.91	0.70
	10	1,622,969,231.27	2,150,070,304.78	0.75
May	11	2,216,830,069.69	2,649,697,711.66	0.84
	12	2,685,312,476.20	3,149,325,118.53	0.85
	13	3,738,660,098.89	3,739,245,706.85	1.00
	14	4,089,879,169.42	4,601,350,592.81	0.89
June	15	6,256,383,767.88	5,698,651,061.16	1.10
	16	7,843,173,852.74	7,014,447,117.53	1.12
	17	9,059,448,106.76	8,330,243,173.90	1.09
	18	10,797,543,570.37	11,116,614,550.65	0.97
July	19	13,008,174,378.25	13,902,985,927.39	0.94
	20	14,489,565,964.09	16,689,357,304.14	0.87
	21	16,658,520,545.00	19,475,728,680.88	0.86
	22	19,226,223,043.60	22,256,177,122.75	0.86
	23	21,965,863,612.77	24,961,713,471.85	0.88

Analysis of Estimated Costs and Remaining Time

This analysis aims to estimate how much additional costs are still needed until the project is completed and to estimate the additional time needed for the project to be completed based on current schedule performance. The resulting analysis is Estimate to Complated (ETC), Estimate at Completion (EAC), Estimate Temporary Schedule (ETS) and Estimate as Schedule (EAS).

1. Estimate to Complete (ETC)

   The formula used in this equation is:

   ETC = BAC - ACWP (JOBS LESS THAN 50%)

   ETC = (BAC-BCWP)/CPI (JOBS MORE THAN 50%)

   Because the Tayan bulking station project is 50% complete, the second formula is used. The Estimate at Complete (EAC) calculation is as follows:

   $$ETC = \frac{34.990.000.000 - 21,965,863,612.77}{2,35} = 25.965.863.612,77$$

2. Estimate at Completion (EAC)

   EAC shows how much the total cost of the project is likely to be until it is completely completed. The formula used in this equation is:

   EAC = ACWP + ETC

3. Estimate Temporary Schedule (ETS)

   The estimated time required to complete the remaining work on the Tayan Bulking Station construction project is reviewed in (week 23) using the following formula:

   ETS = REMAINING TIME / SCHEDULE PERFORMANCE INDEX (SPI)

4. Estimate as Schedule (EAS)

   EAS is one of the indicators in Earned Value Management (EVM) analysis which is used to control project time and estimate the final completion date of the project based on real performance data in the field. The total completion time for the Tayan Bulking Station project uses the following formula:

   EAS = Time Elapsed + ETS (Estimate as Schedule)

The Tayan Bulking Station construction project was targeted to be completed in 34 weeks, but after EAS calculations were carried out, the total project completion time was 35 weeks, meaning there was a 1 week delay in completing the work.

5. CONCLUSION

Based on the results of this study, the conclusions that can be conveyed are as follows:

1. Project cost performance (Cost performance) Beginning of the project (Week 1-9): The project experienced cost overrun. The costs incurred in the field (ACWP) were greater than the value of the work that should have been (BCWP). The CPI index in this period was less than 1. Mid to end of observation (Week 10-23): Cost

performance improved significantly. The project actually became more economical (cost underrun), where the costs incurred were less than budgeted. The CPI index in this period was greater than 1, even reaching 2.35 in week 23. Final Cost Estimate: Although there were fluctuations, the estimated total project cost to completion (EAC) was IDR 34.99 billion, which means it was in accordance with the initial budget (BAC). There was no total cost overrun at the end of the project.

2. Schedule Performance Most of the time (Weeks 1-14 & 18-23): The project experienced a delay (schedule overrun). The work completed (BCWP) was less than planned (BCWS). The SPI index during this period was often less than 1. At certain points (Weeks 15-17): There was an acceleration (schedule underrun) where the work was progressing ahead of schedule. The SPI index during this period was more than 1. Estimated End Time: Although planned to be completed in 34 weeks, based on performance up to week 23, the project was estimated to require a total of 35 weeks for completion. This means there was a final delay of about one week.
3. The resulting cost and time estimates are Rp. 34,990,000,000. The estimated completion time for the Tayan bulking station project is 35 weeks.

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