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Evaluation of Cost and Time Estimates Using The Earned Value Method: A Case Study of The Construction of RU Guest House and Main House

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ABSTRACT

This study evaluates the performance of the RU Guest House and Main House construction project in Bali, focusing on time and cost estimates using the Earned Value Method (EVM). By analyzing the Actual Cost of Work Performed (ACWP), Budgeted Cost of Work Performed (BCWP), and Budgeted Cost of Work Scheduled (BCWS), the study identifies significant delays and cost overruns. The project, initially scheduled for 34 weeks, experienced a 27.99% delay by week 21, with an estimated cost increase of IDR 1,079,046,375. The findings reveal that poor initial planning and logistical constraints, such as narrow access roads for material delivery, contributed to the delays. The study also forecasts an extended completion time of 42 weeks and provides estimates for the total project cost at IDR 13,736,136,610. The results highlight the importance of thorough planning and logistics management to minimize risks. EVM proved to be an effective tool in monitoring and controlling project performance, providing essential insights for improving future project management practices. The study concludes that better planning, logistics, and real-time project performance monitoring are crucial to ensuring project success in both time and budget management.

Keywords: cost estimation, time estimation, earned value, evaluation

INTRODUCTION

Bali Island is one of the international tourist destinations that has been widely recognized to foreign countries. According to the Central Bureau of Statistics of Bali Province (2024) the number of tourist visits to Bali continues to increase every year, where in 2022 it amounted to 2,155,747 people and in 2023 it increased to 5,273,258 people. The number of visitors who come to Bali causes an increase in demand for infrastructure development around the Bali area, which in turn attracts investors to develop businesses in Bali. Of the several types of businesses available, villa rental services are one of the most promising forms of investment (Hayati & Salim, 2019).

Villa construction is one of the property business opportunities with great profit potential, especially if supported by good management. The success of a construction project is highly dependent on structured planning and management, starting from the initial stage to its implementation. One of the main elements in this process is the implementation of effective project management during construction. In every project, aspects of quality, cost, and time are the main concerns that must be managed properly. The quality of work must meet the standards without exceeding the predetermined budget and remain in accordance with the planned schedule (Ali Imron, Teki Tjendani, & Witjaksana, 2022). Therefore, cost and time management is not only an important part of project management, but also a key factor that determines the overall success of the project. This research focuses on analyzing cost and time during project implementation. Cost management involves budgeting, controlling expenditure, and ensuring everything stays within the plan. Meanwhile, time management includes schedule planning,

monitoring work progress, and controlling activities to ensure timely completion. As project complexity increases, close supervision and control become increasingly important, as schedule delays or cost overruns can cause major losses (Kurniawan, Nugroho, Sundari, & Yulianto, 2024).

This can be seen in the construction project of RU Guest House and Main House in Seseh, Cemagi Village, Mengwi District, Badung Regency, Bali, which was carried out by CV. Cipta Karya Utama with a contract value of Rp12,657,090,235. The project was planned to be completed in 34 weeks. However, during its implementation, poor planning led to changes in time and cost, which negatively impacted project performance. By week 21, the work progress was -27.99% behind schedule, risking the project to exceed the contract time if not addressed immediately. Therefore, it is important to conduct an evaluation such as using the earned value method.

In previous studies, there were several researchers who had used the Earned Value Method (EVM) to analyze project performance, both in terms of time and cost (Witjaksana & Reresi, 2012). One example is research conducted by Prayascita (2023), in this study reviewing related cost and time analysis on the implementation of the Villa Maharaja Pererenan project. The results of the analysis show that the project experienced delays in the 24th week of implementation. Another study was conducted by Maulidi et al., (2021), reviewing the cost and time related to the Construction of the Trauma Center and Intensive Care Building. In addition, research conducted by Khairunnisa et al. (2020), used the EVM method to assess cost and time efficiency in a housing project in North Penajan. Furthermore, research conducted by Sri Mahapatni et al. (2022) analyzed the time and cost performance of project implementation on the Pangkung Dalem Bridge Construction on the Gitgit-Wanagiri Road section.

This research aims to analyze the application of Earned Value Method (EVM) in the RU Guest House and Main House Construction project, according to the background that has been described. Evaluation of project performance will be carried out using three main indicators in EVM. Actual Cost of Work Performed (ACWP) measures the total actual costs that have been incurred during project implementation. Budgeted Cost of Work Performed (BCWP) reflects the value of the completed work based on the planned budget. Meanwhile, the Budgeted Cost of Work Scheduled (BCWS) shows the cost that should have been spent on work scheduled to be completed by a certain time (Suksmono & Sari, 2024).

Using these three indicators, the study will objectively assess the progress of the work as well as cost efficiency. This analysis is expected to provide a detailed picture of the project's condition and progress, so that more informed decision-making can be made to support project completion on target. This approach also enables project managers to identify potential risks early and formulate corrective actions effectively. Thus, project success can be achieved optimally, both in terms of time, cost, and quality that has been planned (Annas, Solikin, Harnaeni, & Sunarjono, 2024).

The results of this research are expected to not only provide a clear picture of the benefits of the Earned Value Method (EVM) in project management, but also become a practical reference for other property developers in managing construction projects that are efficient, measurable, and in accordance with predetermined targets. Through this research, it is also expected to contribute to the field of project management, especially in efforts to improve the effectiveness of cost and time management in large-scale and complex projects. Thus, the main questions in this research are.

1. What is the estimated final remaining project time and total project time until the project is completed?
2. What is the estimated remaining cost until the end of the project (ETC) and the total project cost until completion (EAC)?

Literature Review

Previous Research

Research conducted by Putra (2021), taking the title of Cost and Time Analysis with the Earned Value Method on the Jumeirah Pecatu Beach Resort Project. The results of the study obtained in the 24th month were ACWP = IDR 182,018,842,243, BCWP = IDR 176,487,889,443.2, and BCWS = IDR 207,826,542,672.3. In the 24th month the project experienced cost overruns as seen from the cost work index (CPI) value = 0.96961<1. From the schedule aspect, the project experienced delays as seen from the schedule performance index (SPI) value = 0.84921<1. Thus it is predicted that the project will cost Rp 311,276,344,152.2 where this cost is greater than the budget = Rp 301,817,681,818 (an increase of Rp 9,458,662,334). For the predicted final project time it will take 35.78 months to complete which is 1.78 months delay from the planned.

Research conducted by Ramadhan (2022), took the title of Time and Cost Analysis with the Earn Value Method on the Ganefo Mranggen Flyover Construction Project, Demak Regency. The results of calculations based on monitoring from month 9 to month 14 obtained an SPI value of 0.95 which indicates that the implementation time is slower than the original schedule. Furthermore, the schedule variant (SV) is negative, which is 51.7% of the original plan target of 57.094%. The Cost Variant (CV) which is negative is Rp 4,503,789,727.00 while the CPI value is 1.05. The EAC value is obtained at Rp 104,533,261,259.00, this shows that the estimated project cost is less than the project budget at the planning stage. While the estimated time can be seen EAS is 578 days, which means that the estimated project completion time is slower than the planned project completion time.

Research conducted by Nandaprasetya & Dofir (2021), took the title of Cost and Time Control Analysis on the Road Pavement Maintenance Project in DKI Jakarta Province (Pasar Rebo sidewalk) Using the Earned Value Method. Based on calculations of cost and time performance, where the project is delayed because it is not completed within 18 weeks as planned, the weight of the work in the 18th week of implementation has only reached 84%. The performance of project implementation from the cost aspect is not good because the work is carried out more than the budgeted budget (overcost) which can be seen from the Cost Variance value which is negative (-Rp 1,689,357,145.00) in week 18 and the Cost Performance Index which is less than 1, which is 0.877 in week 18. For the difference between the estimated total cost of project expenditures and the planned cost, it is estimated to swell by Rp 2,011,067,634.00.

Research conducted by Bahri & Sembiring (2023) took the title Time Performance Analysis Using the Earned Value Method on the DKI Jakarta High Prosecutor's Office Building Construction Project. The results of this study obtained SV on the DKI Jakarta High Prosecutor's Office Building construction project starting to be in positive numbers in weeks 3 to 16, then the SV value returned to negative numbers in week 17 and moved down until the last week of review (week 28), namely at Rp. -21,584,000.59. For the SPI value in the construction project of the DKI Jakarta High Prosecutor's Office Building began to have a value> 1 in week 3 to week 16 and the SPI value returned to having a value < 1 in week 17 until the last week of review (week 28) with a final SPI value of 0.715.

Research conducted by Alfadin & Witjaksana (2023), took the title of Cost and Time Analysis with the Result Value Method (Case Study: Sembayat Bridge Preservation in Gresik). The total planned cost is Rp 4,489,082,250 while the total cost incurred for 17 weeks is Rp 1,923,940,648.44. When compared to the calculated value of the accountant from the company, which is IDR 1,913,667,654.92, the value spent is IDR 10,272,993.52 greater than the total planning cost. The total planning days are 270 days with work time that has been running for 17 weeks (151 days). The remaining Estimate Date Complete value reviewed based on weeks 1 to 17 data is 190.2 days. As for the Estimate All Schedule (EAS) value which is an estimate

of the overall duration of project handling is 191 days. This means that the implemented project is expected to be completed in accordance with the target in the planning.

Construction Project Management

Project management is a series of activities that include planning, organizing, directing, and controlling company resources to achieve short-term targets that have been formulated. The main objective of project management is to ensure that the project is carried out in accordance with the schedule, budget, and quality standards that have been set.

To achieve the goals and objectives set in a project, there are three main limitations known as the Triple Constraint, namely (Maulidi et al., 2021).

1. Cost: In project implementation, the cost factor is a major consideration because it relates to the large amount of investment that must be spent by the project owner, which is vulnerable to the risk of failure. Construction costs are often affected by economic conditions, such as rising prices of materials, equipment, and labor wages. In addition, inflation, rising bank interest rates, limited working capital, or delayed activities due to delays can also cause fluctuations in financing.
2. Time: In addition, there are influences from productivity, availability of facilities and infrastructure at the project site, and special events such as legal disputes. Problems that affect construction execution time are generally caused by the delivery mechanism, such as delays in the planning schedule, changes in work during construction, schedule feasibility, labor productivity, and government policies related to safety, implementation methods, environmental impact, and labor.
3. Quality: Meanwhile, issues that impact the quality of work outcomes are usually related to the technical capabilities and skills of human resources. Examples include the development of planning criteria and specifications, financial management, material procurement procedures, equipment use, and supervision. Beyond this, there are a range of additional issues that affect the schedule, delivery time and quality of the work, which must be properly managed to ensure project success.

The three constraints have a mutual influence on each other. For example, if the product performance stated in the contract is to be improved, this usually requires an increase in quality, which in turn may cause costs to rise beyond budget. Conversely, if efforts are made to keep costs down, this often requires compromises to quality and schedule. From a technical point of view, the success of a project is measured based on the extent to which the three objectives, namely cost, schedule, and quality, are achieved. Over time, other parameters such as scope of work were also added, so that the measure of project success includes scope, cost, schedule, and quality (Ike Novita, 2024).

Earned Value Method

The Basic Elements of Earned Value consist of various components that support each other to provide a comprehensive picture of project performance and status. These elements serve as key measurement tools in managing projects effectively, by integrating the dimensions of time, cost, and deliverables. Some of the main elements include:

1. Budgeted Cost of Work Schedule (BCWS)

   Is a budget of costs that are planned to be allocated in accordance with the work schedule that has been prepared. BCWS reflects the estimated costs that should be incurred at each stage of work based on the project time plan. This concept is used as an initial benchmark in measuring project performance, by comparing the planned budget and realization in the field.

   $\text{BCWS} = \%(\text{bobot rencana})\ x\ RAB$
2. Budgeted Cost for Work Performed (BCWP)

   It is a value that reflects the budget allocated for the work that has been completed in a certain period of time, according to the initial project plan. BCWP

measures the extent to which the physical progress of the work is within the planned budget, providing an overview of the actual performance of the project compared to the predetermined schedule.

BCWP=% (realization weight) x RAB

3. Actual Cost for Work Performed (ACWP)

   Is a representation of the total actual expenditure that has been incurred to complete the work within a certain period of time. This value includes all costs that have been incurred during project implementation, including the cost of materials, labor, equipment, and other expenses directly related to the completed work.

Project Cost and Completion Time Forecast

Estimating the cost and time of project completion involves several methods to predict the total cost and duration of the project, including (Khairunnisa et al., 2020):

1. Estimated to Complete (ETC)

   Estimated to Complete (ETC) is an estimate of the cost required to complete the remaining project work, assuming that the current pattern of performance will continue in the same way until the project is completed. This means that based on the performance results of the project up to a certain point, the estimated cost to complete the remaining part is calculated by considering consistency in the use of resources, costs, and time. ETC helps project managers to estimate the amount of additional costs required to complete the project, so they can plan a more accurate budget and identify potential risks that might affect the project budget in the future.

   a. An estimate of the cost to complete the remaining work is made when the physical progress of the project is less than 50%.

      $\text{ETC} = anggaran\ (RAB) - BCWP$

   b. An estimate of the cost to complete the remaining work is made when the physical progress of the project is more than 50%.

      $$\text{ETC} = \frac{anggaran\ (RAB) - BCWP}{CPI}$$

2. Estimate at Completion (EAC)

   Estimated at Completion (EAC) is an estimate of the total cost required to complete the project to completion. EAC is calculated by adding Actual Cost for Work Performed (ACWP), which is the cost that has been incurred to date, to Estimated to Complete (ETC), which is the estimated cost required to complete the remaining work. By calculating EAC, project managers can get a more accurate picture of the total costs that will be incurred at the end of the project, and can identify potential cost overruns or efficiencies in budget management. The EAC also serves as a tool to monitor and control project expenditures, as well as to plan corrective measures if needed to keep the project within the established budget.

   a. Actual Cost for Work Performed (ACWP) is added to the ETC cost estimate assuming project performance will remain constant until the project is completed.

      $\text{EAC} = ACWP + ETC$

   b. RAB divided by CPI. This formula is used when there is no variance in the project cost budget.

      $$\text{EAC} = \frac{anggaran\ (RAB)}{CPI}$$

3. Estimated Temporary Schedule (ETS)

   Estimated Temporary Schedule (ETS) is an indicator used to estimate the duration of time required to complete all remaining project activities. This value is calculated based on the actual performance that has been achieved to date, taking into account the time efficiency used during project implementation. With ETS, project managers can get a

more specific picture of the additional time needed to complete the work, making it easier to re-plan or make strategic decisions if needed. The ETS value also serves as an important evaluation tool to ensure that project implementation remains on schedule (Ike Novita, 2024).

$$\text{ETS} = \frac{sisa\ waktu}{SPI}$$

4. Estimate at Schedule (EAS)
   Estimated at Schedule (EAS) is an estimate of the total time required to complete the entire project, which includes the time that has been used to date as well as the time required to complete the remaining work. The EAS value is calculated by considering the progress of the project up to a certain point, as well as predicting the duration required to complete the unfinished parts of the project. EAS provides a more comprehensive picture of the estimated project completion time, which can assist project managers in monitoring whether the project will be completed according to the predetermined schedule. By using EAS, the project team can assess the overall time performance of the project and take proactive steps to address potential delays or obstacles that may arise in the future. EAS is also important in planning resources and allocating time efficiently so that the project can be completed on time (Ike Novita Sari, 2024).

$$\text{EAS} = waktu\ selesai + ETS$$

The purpose of this study is to evaluate the performance of the RU Guest House and Main House construction project using the Earned Value Method (EVM) to assess time and cost estimations. By analyzing the actual progress against the planned schedule and budget, the study aims to identify discrepancies and predict the final costs and time to completion. The findings from this study will provide valuable insights into improving project planning, time management, and cost control. The benefits include offering practical recommendations to prevent delays and cost overruns, enhancing project management strategies for future construction projects, and providing a framework for more accurate monitoring and evaluation.

METHOD

Implementation and Timing of Research

This research was conducted at the Ru Guest House and Main House Construction Project located in Cemagi Village, Mengwi District, Badung Regency, Bali Province. This project location was chosen because of its relevance to the study being conducted, especially regarding project management and implementation of construction methods.

The research stages included field surveys, interviews with relevant parties, and collection of project technical data, such as implementation schedules, cost budgets, and construction technical specifications. The research was scheduled for a specific period in 2024, which included direct observation at the project site to obtain primary data. This entire process was designed to support an accurate analysis that meets the research objectives.

Data Collection Procedure

This research was conducted on the Ru Guest House and Main House Construction project located in Seseh, Badung Regency, Bali. The main source of research data comes from the contractor implementing the project, which provides important information related to the construction implementation process. This data is used to analyze various aspects relevant to the research objectives.

The types of data collected include secondary data and the results of the literature study. Secondary data included official documents obtained from the contractor, which supported the systematic collection of information. This information forms the basis for understanding the

various elements that influence project implementation. The data used in this study includes several important components, including the project Budget Plan (RAB), project implementation schedule (schedule), weekly project reports containing the progress of activities during implementation, and actual cost data incurred during construction. All of this data became the main reference in the research analysis and evaluation process.

Data Analysis Technique

a. BCWS/BCWP

BCWS / BCWP refers to the planned cost of the work scheduled within a certain period. The calculation is done by multiplying the percentage of work progress listed in the project schedule by the total implementation cost recorded in the Budget Plan (RAB).

b. ACWP (Actual Cost of Work Performed)

ACWP is obtained from data provided by the project finance department. This value is an estimated cost that is considered the real cost that has been used in the project. This cost is calculated by multiplying the amount of materials and labor used by the unit price of materials and wages prevailing in the field (real unit price).

c. Projected Cost Expenditure and Project Completion Timeframe

Projections of project completion costs and schedules are based on indicators obtained from existing reports. These projections provide an estimate of the cost required at the end of the project (Estimate At Completion = EAC) and an estimate of the project completion time (Estimate All Schedule = EAS). These estimates are very useful as they can provide an early warning of project progress, especially if the trends seen at the time of reporting have not changed.

RESULTS AND DISCUSSION

Project Overview

The Ru Guest House and Main House Construction Project is a construction project that includes the construction of four buildings, namely one main house and three villas, located in Cemagi Village, Mengwi District, Badung Regency, Bali. The project is implemented by the contractor CV. Cipta Karya Utama.

The following is an overview of the Ru Guest House Construction project which is the object of research.

Project Name : Construction of Ru Guest House and Main House
Project Address : Cemagi village, Mengwi sub-district, Badung district, Bali.
Implementing Contractor : CV. Cipta Karya Utama
Total Contract Value : Rp. 12,657,090,235.00
Project Area : Area of 1 Main House Unit 857.21 m2
Area of 3 Guest House Units 780.59 m2
Project Implementation : July 2024 - February 2025
Implementation Plan : 34 weeks

Calculation of BCWS, BCWP, and ACWP

The calculation of BCWS, BCWP, and ACWP values for each week of project implementation is stated as follows:

1. BCWS/PV

The PV calculation for week 15 is as follows.

$$PV = \%Progress\ Rencana\ x\ Nilai\ Anggaran\ Biaya\ Proyek$$
$$= 50{,}80\%\ x\ Rp.12.657.090.235$$
$$= Rp.6.429.322.015$$

2. BCWP/EV
   The EV calculation for week 15 is as follows.

$$EV = \%Progress\ Realisasi\ x\ Nilai\ Anggaran\ Biaya\ Proyek$$
$$= 30{,}917\%\ x\ Rp.12.657.090.235$$
$$= Rp.3.913.158.482$$

3. ACWP/AC
   The actual cost paid by the Owner for the construction of Ru Guest House and Main House is calculated in monthly periods. Therefore, in order to obtain the actual cost in the weekly period, a cost approach is taken. This approach assumes that actual costs are incurred linearly. Table 1 shows the AC calculation table.

Table 1. Actual Cost Value

Week 1	Monthly Actual Cost	Weekly Fee	AC (ACWP)
15	IDR 1,471,859,866	IDR 294,371,973	IDR 5,159,733,068
16		IDR 294,371,973	IDR 5,454,105,042
17		IDR 294,371,973	IDR 5,748,477,015
18	IDR 857,886,560	IDR 214,471,640	IDR 5,962,948,655
19		IDR 214,471,640	IDR 6,177,420,295
20		IDR 214,471,640	IDR 6,391,891,935
21		IDR 214,471,640	IDR 6,606,363,575

(Source: Researcher's Process, 2024)

Thus, the calculation of BCWP, BCWS, and ACWP is stated in table 2 as follows.

Table 2. Calculation of BCWS, BCWP, and ACWP

Week 1	PV (IDR)	EV (IDR)	AC (IDR)
15	6.429.322.015,03	3.913.158.481,63	5.159.733.068,40
16	6.936.464.021,63	4.509.307.431,70	5.454.105.041,60
17	7.348.725.330,68	4.961.545.265,80	5.748.477.014,80
18	7.802.427.668,64	5.103.304.676,43	5.962.948.654,76
19	8.256.130.006,60	5.242.532.669,01	6.177.420.294,72
20	8.694.607.416,83	5.385.557.788,67	6.391.891.934,67
21	9.070.600.479,53	5.527.317.199,30	6.606.363.574,63

(Source: Researcher's Process, 2024)

I.

CALCULATION OF ESTIMATED TEMPORARY SCHEDULE (ETS)

The Estimated Time for Remaining Work (ETS) can be calculated by dividing the remaining time of the project duration by the Schedule Performance Index (SPI). The study was conducted at week 21.

$$ETS = \frac{Sisa\ Waktu}{Schedule\ Performance\ Index\ (\text{SPI})}$$
$$= \frac{13\ Minggu}{0{,}61}$$
$$= 21\ minggu$$

The calculation of the Estimated Temporary Schedule (ETS) for the following weeks is done with the same method as the previous calculation. The results of the ETS value for each week can be seen in Table 3.

Table 3. Estimated Temporary Schedule (ETS) value

Week 1	SPI (BCWP/BCWS)	Remaining Time (weeks)	Estimated Time of Remaining Work (ETS) (Remaining Time/SPI)
15	0,61	19	31
16	0,65	18	28
17	0,68	17	25
18	0,65	16	24
19	0,63	15	24
20	0,62	14	23
21	0,61	13	21

(Source: Researcher's Process, 2024)

ESTIMATE AT SCHEDULE CALCULATION

The Estimated Total Project Time (EAS) is obtained by summing the Reporting Time with the Estimated Time for Remaining Work (ETS). The study was conducted at week 21.

$EAS = \text{Waktu Selesai Mingguan} + \text{ETS}$

$= 21\ Minggu + \ 21\ Minggu$

$= 42\ minggu$

The calculation of Estimated at Schedule (EAS) for the following weeks is done with the same method as the previous calculation. The results of the EAS value for each week can be seen in Table 4.

Table 4. Estimated at Schedule (EAS) Value

Week 1	Estimated Time of Remaining Work (ETS) (Remaining Time/SPI)	Project Total Time Forecast (EAS) (Finish Time+ETS)
15	31	46
16	28	44
17	25	42
18	24	42
19	24	43
20	23	43
21	21	42

(Source: Researcher's Process, 2024)

Estimated to Complete (ETC) calculation

The Estimated to Complate (ETC) value is obtained by calculating the difference between the Budgeted Cost (RAB) and Earned Value (EV). The study was conducted in week 15.

$ETC = Anggaran\ Biaya - Earned\ Value$ (EV)
$= Rp.12.657.090.235 - Rp.3.913.158.482$
$= Rp.8.743.931.753$

The Estimated to Complate (ETC) calculation for the following weeks is done with the same method as the previous calculation. The results of the ETC value for each week can be seen in Table 5.

Table 5. Calculation of Estimation To Complete

Week 1	RAB	EV (BCWP)	Forecasted Remaining Cost (ETC) (RAB-BCWP)
15	IDR 12,657,090,235	IDR 3,913,158,482	IDR 8,743,931,753
16		IDR 4,509,307,432	IDR 8,147,782,803
17		IDR 4,961,545,266	IDR 7,695,544,969
18		IDR 5,103,304,676	IDR 7,553,785,559
19		IDR 5,242,532,669	IDR 7,414,557,566
20		IDR 5,385,557,789	IDR 7,271,532,446
21		IDR 5,527,317,199	IDR 7,129,773,036

(Source: Researcher's Process, 2024)

Estimate At Completion Calculation

The Estimated at Completion (EAC) value is obtained by summing the Actual Cost (AC) with the Estimated to Complate (ETC). The study was conducted in week 15.
An example of the calculation in week 5, as follows:
$EAC = Actual\ Cost$ (AC) $+ Estimed\ to\ Complate\ (ETC)$
$=$ Rp 5.159.733.068 + Rp 8.743.931.753
$=$ Rp. 13.903.664.822

The Estimate at Completion (EAC) calculation for the following weeks is done with the same method as the previous calculation. The results of the EAC value for each week can be seen in Table 6.

Table 6. Estimate at Completion (EAC) value

Week 1	AC (ACWP)	Forecasted Remaining Cost (ETC) (RAB-BCWP)	Total Project Cost Forecast (EAC) (ACWP+ETC)
15	IDR 5,159,733,068	IDR 8,743,931,753	IDR 13,903,664,822
16	IDR 5,454,105,042	IDR 8,147,782,803	IDR 13,601,887,845
17	IDR 5,748,477,015	IDR 7,695,544,969	IDR 13,444,021,984
18	IDR 5,962,948,655	IDR 7,553,785,559	IDR 13,516,734,213
19	IDR 6,177,420,295	IDR 7,414,557,566	IDR 13,591,977,861
20	IDR 6,391,891,935	IDR 7,271,532,446	IDR 13,663,424,381
21	IDR 6,606,363,575	IDR 7,129,773,036	IDR 13,736,136,610

(Source: Researcher's Process, 2024)

Discussion of PV, EV, and AC Calculation Results

There are several important points that can be discussed based on the results of the calculation of the Planned Value (PV), Earned Value (EV), and Actual Cost (AC) values. The analysis of these three values provides a clear picture of project performance, including the efficiency of budget utilization and work progress compared to the original plan. This discussion includes identifying the causes of the difference between these values, their impact on the project schedule and cost, and strategic steps that can be taken to optimize project implementation. The following is a more detailed description of the results of the calculation of PV, EV, and AC values.

1. During the period from week 15 to week 21, the Earned Value (EV) value is lower than the Planned Value (PV). This indicates that the project implementation was delayed compared to the planned schedule. The main factor causing this delay is the initial planning which is less mature and access to the project site of large vehicles such as trucks cannot enter, resulting in the material that will enter being hampered.
2. In addition, the Actual Cost (AC) value in the period is lower than the Planned Value (PV), which indicates that the project expenditure is still below the planned budget. However, when compared to the Earned Value (EV) value, the actual costs incurred exceeded the supposed costs according to the progress of the project that had been achieved.

Discussion of Estimated Cost and Project Completion Time

There are several important discussion points that can be raised based on the calculation of the Estimate to Complete (ETC), Estimate at Completion (EAC), Estimate to Schedule (ETS), and Estimate at Schedule (EAS) values. Analysis of these four indicators provides in-depth insight into the projected cost and schedule required to complete the project. The ETC value helps estimate the additional costs still needed to complete the work, while the EAC value provides an overview of the total project cost to completion, including the actual costs already incurred.

The results of the ETC and EAC values, including the estimated cost from week 15 to week 21 show a decrease in each week, which means that the estimated final cost of the project is decreasing. However, the final cost estimate is still higher than the pre-planned cost. Where the ETC and EAC cost estimates until the project is completed show that with a delay of -27.99% at week 21, it will cost Rp.13,736,136,610 to complete the project. Assuming the project performance remains the same as in week 21, where the progress shows a deviation of -27.99%, it is estimated that there will be a loss of Rp. 1,079,046,375 compared to the initial contract value.

Meanwhile, the ETS value provides an estimate of the additional time required to complete the project based on current performance, and the EAS value shows the projected total project completion time. The estimated time from week 15 to week 21 shows a longer duration compared to the project plan time. The ETS (Estimate to Schedule) and EAS (Estimate at Schedule) time estimates until project completion show that with a delay of -27.99% at week 21, the duration originally planned for 34 weeks swelled to 42 weeks. This means that the project completion time is almost double the previously planned schedule.

CONCLUSION

Based on the research findings and discussion, the study concludes that from week 15 to week 21, the estimated project completion time, as indicated by the ETS (Estimate to Schedule) and EAS (Estimate at Schedule) values, exceeded the planned schedule. By week 21, the project experienced a delay of -27.99%, extending the originally planned 34-week duration to 42 weeks. This substantial increase in completion time, nearly doubling the initial schedule, had a significant impact on both time and resource efficiency.

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