



## **Analysis of Project Cost and Time Performance Control Using Earned Value Method Analysis (EVM-A) (Case Study of Concrete Road Construction Project)**

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### **Keywords**

*Performance; Cost; Time;  
Construction; Performance*

### **Abstract**

Construction projects have a high level of project complexity. Controls generally separate between the accounting system for costs and the construction project schedule system. The purpose of this research is to find out how Earned Value is applied in project performance and to estimate project costs and time. This yield value method includes Project Implementation Progress Reports and project financial accounting data at the reporting date, then processed to obtain BCWS (Budgeted Cost of Work Schedule), ACWP (Actual Cost of Work Performance), and BCWP (Budgeted Cost of Work Performance). From the results of control analysis and forecasting the total Estimate All Schedule (EAS) is 9 weeks, the total planning time is 16 weeks. This means the project performance runs 4 weeks faster than the initial plan time. where from the results of project performance evaluation control, it is estimated that the project can be completed in its entirety in approximately 14 weeks from the planned duration of 16 weeks or two weeks faster than the duration of the initial plan and in terms of actual costs it is estimated that there will be an overall savings of around 10.55% of the actual costs that have been realized.

### **1. Introduction**

Construction projects have a high level of project complexity. Sometimes there are delays in progress or cost overruns (Kaming et al. 1997). Controls generally separate between the accounting system for costs and the construction project schedule system (AHMAD SUHAIMI, Nawawi, and PUTEH SALIN 2016). The cost accounting system generates performance reports and project cost predictions, while the schedule system generates project completion status reports (Anbari 2003). The two reports complement each other, but can provide different information about project conditions, so a system is needed that is able to integrate time and cost information (Baiden, Price, and Dainty 2006).

For this purpose, the concept of Result Value can be used as a performance tool that integrates cost and time aspects (Bovea and Pérez-Belis 2012). Outlines/objects of project control can be identified, such as time and schedule, the time spent being longer or according to plan. Then, budget and costs, the budget used exceeds the initial budget that has been determined or not.

The formulation of the problem in this study is how is the performance of the Concrete Road Construction project at Aryamas Residence Housing, Takalar Regency, South Sulawesi Province in terms of time and cost and projected delays/progress.

The research objective to be achieved is to examine whether the implementation of a project at the time of reporting is still in accordance with the planned budget and time schedule or not (Mabert, Soni, and

Venkataramanan 2003). Analyze the related elements in the form of achievement, cost and time to find out whether the progress of project implementation is worth the part of the budget when measured by the original plan, and estimate the total cost and time needed until the project is completed.

## 2. Materials and Methods

### a. Types of research

This research uses quantitative research methods. Where quantitative research is a type of research that is more systematic, structured, specific, and also well planned from the start to get a conclusion (Miles 1990). Quantitative research places more emphasis on numbers which makes it more detailed and clearer. In addition, the use of tables, graphs and diagrams makes it easier to read (Pinker 1990).

### b. Time & Location of Research

The time referred to in this study is the overall time of the course of research related to data collection during research (Posada-Quintero and Chon 2020). The time needed by researchers to collect research data is around 7 weeks, starting from March 12 2019 to April 25 2019. The research location in question is the place where researchers get research data for this final project (Cypress 2018). Researchers conducted research on the Concrete Road Construction Project for Infrastructure, Facilities and Utilities (PSU) Public Houses Region II in the Aryamas Residence Housing District. Takalar, Prov. South Sulawesi. Especially on 8 road sections, namely 1 section in Block C, 3 sections in Block D, and 4 sections in Block E.

### c. Research Data Sources

What is meant by the source of data in research is the subject from which the data can be obtained. Data sources are divided into two, namely primary data and secondary data (Shimwell et al. 2022). Primary data is data obtained by researchers directly (first-hand). While secondary data is data obtained by researchers from existing sources. In this study, data from both sources were used. Primary Data Primary data is in the form of observations of researchers to the project site. Secondary Data Secondary Data is data that is already available so we just need to find and collect it. We can obtain secondary data more easily and quickly because it is already available to the project executor. Secondary data in the form of: Cost Budget Plan (RAB)/Implementation Cost Budget Plan (RAP), Schedule / (S-Curve), Detailed Engineering Design (DED), weekly Reports.

### Data analysis

From the data that has been obtained, then the work weight is calculated for each item. Then an analysis of cost and time control is carried out using several approaches, namely:

- a. Calculation of Planned Cost or PV (Planned Value) or Budgeted Cost for Scheduled Work (BCWS)

Planned Cost or BCWS by calculating the percentage of the work plan multiplied by the total project cost that has been planned. Formula used:

$$BCWS = \% Rencana \times BAC \dots \dots \dots (1)$$

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

Percentage of completion/realization multiplied by the total planned real cost of the project. The formula used is:

$$BCWP = \% \text{ Aktugulung} / \times BAC \dots\dots\dots(2)$$

c. Calculation of Schedule Variance (SV)

SV calculation to find out the deviation between BCWP and BCWS values. If the SV value is positive, then more project work has been carried out than planned. Conversely, if a negative value indicates poor job performance because less work is done than the planned schedule. According to (Desmi, 2011), the formula used:

$$SV = BCWP - BCWS = EV - PV \dots\dots\dots(3)$$

d. Calculation of Cost Variance (CV)

Calculation of CV to find out whether the project being carried out is still within the budget limit or exceeds the budget. According to (Desmi, 2011), the formula used is:

$$CV = BCWP - ACWP = EV - AC \dots\dots\dots(4)$$

e. Calculation of Time Performance Index / Schedule Performance Index (SPI)

SPI calculation to compare the weight of work in the field and in planning. If the SPI value = 0 then the project is on time, if the SPI value < 1 then the project progress is behind compared to the plan. And conversely, if SPI > 1 then progress is faster than planned. As According to (Efe and Demirors 2019),

Formula used:

$$SPI = BCWP / BCWS = EV / PV \dots\dots\dots(5)$$

a. Calculation of Cost Performance Index (CPI)

CPI calculation by comparing the value of work that has been physically completed (BCWS) with the costs incurred in the same period (ACWP). According to, the formula used is:

$$CPI = BCWP / ACWP = EV / AC \dots\dots\dots(6)$$

3. Results and Discussions

Research Flow Chart

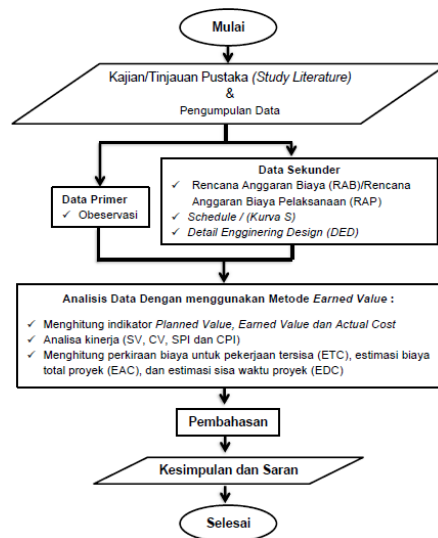


Figure 1. Research Flowchart

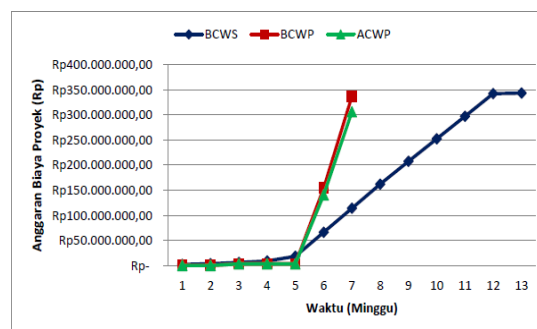


Figure 3. Time-Based Result Value Concept Graph

i. Calculation of Cost Variance (CV)

Cost Variance (CV) is the difference between the value obtained after completing the work packages and the actual costs during project implementation. Calculation of Cost Variance (CV) in Week 1 to Week 7 is as follows:

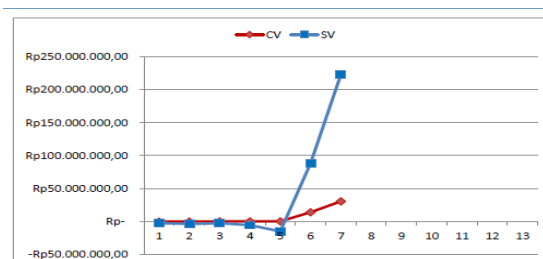


Figure 4. Integrated Cost and Schedule Variance Graph

ii. Calculating the Cost Performance Index (CPI)

The Cost Performance Index (CPI) is used to determine the cost status of the project. The calculation for the CPI value obtained from week 1 to week 7 is as follows.

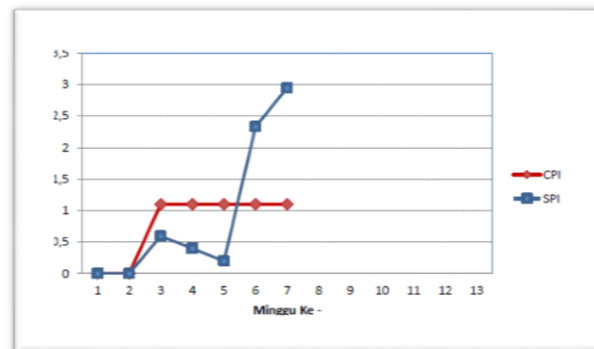


Figure 5. Graph of CPI and SPI Implementation Conditions

- iii. Estimated Cost for remaining work (Estimate Temporary Cost/ETC) and time for remaining work (Estimate Temporary Schedule/ETS).

Projection of delays/progress and Projection of Cost Overrun/Cost Underrun at the end of the Concrete Road Construction project at Aryamas Residence Housing District, Kab. Takalar, South Sulawesi Province. From the cost aspect, the estimated cost for the remaining work (ETC) and the estimated total project cost (EAC) obtained an EAC value of Rp. 312,087,921.25 while the BAC or RAB value was Rp. 343,296,000.00, this means that at the end of the project later it is estimated that there will be a profit of Rp. 31,208,078.75 (9.09% of RAB). From the time aspect, the calculation of the estimated time for remaining work (ETS) is 2 weeks. Calculation of estimated total project time (EAS) is (time used + ETS)  $7 + 2 = 9$  weeks, total planned time is 13 weeks. This means the project performance runs 4 weeks faster than the initial plan time

#### 4. Conclusion

From the results of the application of the yield value method it is known that the results of the review in the 7th week obtained BCWS = IDR 114,207,599.16; BCWP = IDR 336,878,761.28; ACWP = IDR 306,254,055.74; Analysis of the Cost Performance Index (CPI) in the 7th week shows (CPI > 1) better performance than planning while the Schedule Performance Index (SPI) shows a value (SPI > 1) in terms of work performance earlier than scheduled. And it can be seen that the estimated final project cost / Estimate At Complete (EAC) is IDR 312,087,921.25 with a planned budget of IDR 343,296,000.00. From the calculation results, the estimated total project time/Estimate All Schedule (EAS) is 9 weeks, the total planned time is 13 weeks. This means the project performance runs 4 weeks faster than the initial plan time. From the results of the analysis of project performance evaluation control, it is estimated that the project can be completed in its entirety in approximately 14 weeks from the planned duration of 16 weeks or two weeks faster than the duration of the initial plan and in terms of actual costs it is estimated that there will be an overall savings of around 10.55% of the actual costs that have been realized.

Thus the results of the analysis of performance evaluation control on the project show an increase in time and cost performance which can be used as suggestions and considerations in implementing similar projects in the future. In addition, the benefits of applying the Earned Value Management (EVM) method are that it can assist in evaluating project performance and can show the amount of time/cost performance and deviations that occur in the project so that control can be carried out before deviations get worse, especially for project implementers, in this case the parties contractor. Overall, the biggest obstacle causing the time deviation in the project in this study is due to the very limited number of local workers, so the best solution is to increase the number of workers by sending workers from the Takalar district so that the project

implementation schedule can return to normal and avoid delays and cost overruns. actual projects, especially road projects in the area. Obstacles found during research where detailed actual data for actual costs are relatively difficult to obtain in detail, this is also an obstacle in the application of the use of the EVM method as an instrument for measuring cost performance and project time. Therefore, in future studies, it may be necessary to have detailed financial administration management for the construction contractor for each item of costs incurred during the implementation of the construction project as supporting data in applying the EVM method.

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