

Analysis of Project Time Using the Earned Value Method Concept on the Situbondo District Bagor Bridge Replacement Project

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Abstract

This research aims to analyze the time and cost efficiency of the Bagor Bridge Replacement Project in Situbondo Regency using the Earned Value Method. The research employs a qualitative descriptive approach, where data is collected through literature studies, field observations, and analysis of project documents such as plan drawings and weekly reports. Data analysis techniques include calculating several indicators, including Cost Performance Index (CPI), Schedule Performance Index (SPI), and Variance at Completion (VAC). The results showed that in weeks one to nine, the project ran according to the planned schedule, but there was a delay between weeks ten to nineteen. In the twentieth to twenty-fourth week, the project made progress again. The effectiveness of project time and cost control was obtained with a score value of 1.603, which indicates that project control is very effective. Based on these results, it is recommended that the implementing contractor compile detailed daily reports to monitor cost overruns and anticipate existing risks. The use of Earned Value method can be combined with other methods to maximize project control. In addition, logistics, equipment, and resource management should be considered to prevent unwanted problems.

Keywords: Earned Value Method, Time Efficiency, Cost Efficiency, Project Control, Bagor Bridge.

1. Introduction

An assignment is a task that needs to be finished within a specific timeframe and budget in order to accomplish the intended outcomes originally. A project can also be defined as a series of actions or work that is planned and carried out to achieve a specific goal within a certain period of time (Nurtsani et al., 2017; Rahmanto & Janizar, 2022). Planning, execution, supervision, and completion are parts of projects that usually involve limited resources, such as budget and manpower (Ndunguru, 2023). Examples of projects include scientific research, infrastructure development, and software development. In the process of implementing a project, there are several obstacles or barriers that often occur. These include an insufficient amount of resources (cost, people, and equipment), the experience of the implementation team with the type of project at hand, and their expertise in using equipment. Some of these factors can cause delays or deviations from the plan (Anwar & Hayati, 2013; Kartikasari, 2014; Widayanti et al., 2017).

Inadequate project management can lead to substantial setbacks in planning and increased expenses during implementation. Employing the concept of earned value, also known as EV, is a method utilized to supervise both time and cost in a project (Pahalawan, 2014; Wijaya & Hartati, 2016). The concept of earned value involves determining a budget by taking into account the progress made in completing the work. Performance can be measured



based on the amount of budget available for the project and the amount of work completed at a given time. Thus, the relationship between the budget spent and the physical progress achieved can be known in the future (Ariana & Lestari, 2023). Work completion time is very important during project implementation. The way in which work is carried out, the allocation of manpower, and the accuracy of material inventory forecasting all play a role in determining the duration of a project. Project control methods are needed to overcome the problem of work delays. The Earned Value method is a control that can be used.

The technique known as earned value analysis is utilized to evaluate the progress and effectiveness of project costs and schedules. This approach facilitates the assessment of project progress, provides insights on project duration, predicts project expenses, and identifies discrepancies promptly (Mughni et al., 2024). Therefore, there is a need to implement a technique to enhance the efficiency of overseeing and managing project tasks. One approach that addresses the aforementioned issues is the Earned Value Method. This technique is employed to evaluate how well a project is performing in regards to expenses and timing, to forecast the remaining costs of the project after the review period, and to predict the final cost of the project after the review period (Irniawan et al., 2024).

Situbondo Regency has an area of 1,638.50 km², or 163,850 ha, and is located on the north coast of the Horseshoe region, East Java, approximately 150 km from west to east. Situbondo is the capital of Situbondo District. Of the total sub-districts, 13 are located in coastal areas. Sumbermalang sub-district has an altitude of 100-1,223 meters above sea level, and Banyuputih sub-district has the largest area, 481.67 km². In 2019, climatic conditions recorded the highest rainfall of 3,549 milli/meter in December, with 16 most frequent rainy days. Situbondo Regency is located at 7°35'-7°44' South latitude and 113°30'-114°42' East longitude.

Situbondo Regency originally had Situbondo as its capital and was known as Panarukan Regency. During the Dutch administration of Governor General Daendels, who built a forced labor road along the north coast of Java, the road was called "Jalan Anyer - Panarukan" or better known as "Jalan Daendels". However, during the administration of Regent Achmad Tahir (± 1972), the name was changed to Situbondo Regency.

In general, Situbondo Regency is a lowland with a slope between 0° and 45°. Most of the area is well flooded, with 1,629.03 km² (99.42%) never flooded, while 0.78 km² (0.05%) is sometimes flooded and 8.69 km² (0.53%) is always flooded. Situbondo Regency can be divided into three regions based on their potential and geographical conditions. The northern region, located by the coast and sea, has great potential for fisheries development, including fish farming and fishing; the central region, which has a flat topography, has potential for agriculture; and the southern region, which has a sloping topography, has potential for plantations and forestry.

One of the bridges in Situbondo is the Bagor Bridge that connects the two regions. These bridges are usually built to facilitate public transportation and improve accessibility. Geographical conditions and local requirements can determine the design and construction of these bridges. To replace the old Bagor Bridge, which was built of brick trusses and was less than seven meters wide, a new bridge was needed that had a width that met provincial road and bridge standards. In addition, to compensate for the load or load of vehicles passing through, as vehicles passing through provincial roads are currently heavier.

During the replacement of the Bagor Bridge, there will be an emergency bridge called the Bailey bridge. This bridge is 45 meters long, with a vehicle track width of 4.20 meters, and an approach road length of about 35.00 meters plus 25.00 meters. This bridge has a vehicle capacity of up to 20 tons (vehicle weight and load). Based on this background, the researcher

conducted a study to understand that the costs and implementation time that have been issued are in accordance or not with the plan. The goal of this study is to assess the efficiency of the Bagor Bridge Replacement Project in terms of time by utilizing the Earned Value Concept Method.

2. Methods

2.1. Research Subject

This study focuses on analyzing the efficiency of time and cost in the Bagor Bridge Replacement project in Situbondo Regency through the application of the Value Concept.

2.2. Location and Time of Research

The research location is at the Bagor Bridge Replacement Project in Situbondo Regency in week 31.

2.3. Data Collection Procedure

The study involved conducting data collection using the following methods:

- Primary data includes literature studies collected and field observations.
- Secondary data includes plan drawings, time schedule, weekly reports, monthly reports and budget plan.

2.4. Data Analysis Technique

Data analysis involves converting data into a format that is easily comprehensible and can be applied to address issues. The research employed descriptive qualitative analysis, which involves examining the collected data, and subsequently outlining the procedure and outcomes of the analysis.

3. Results and Discussion

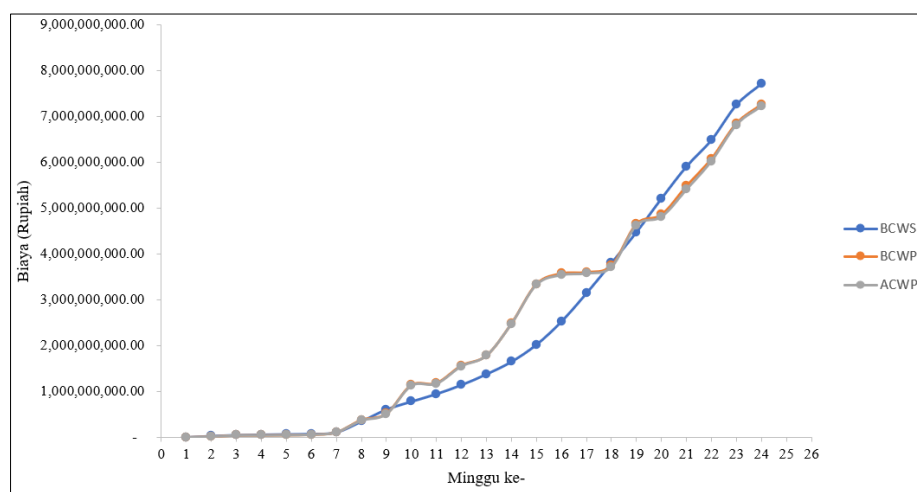


Figure 1. Progress Schedule and Project Budget

The information presented in the table and graph reveals that from week 1 to week 9, the project's progress aligns with the established timeline, while in week 10 to week 19 it is delayed and in week 20 to week 24 it is progressing again. The project cost from week 1 to week 24 does not exceed the budget that has been determined.

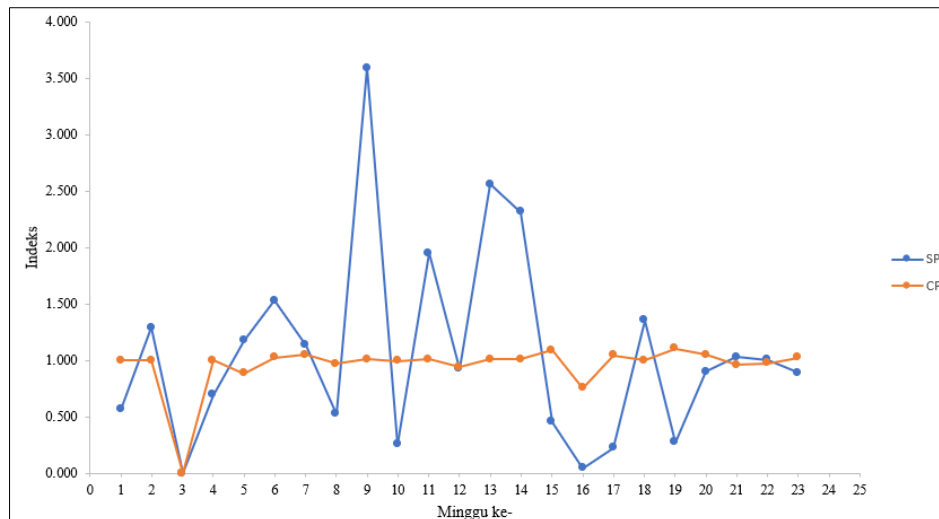


Figure 2. Project Schedule and Cost Performance Index

To assess how well control measures are working, whether in terms of time or money, it is important to carefully monitor the project right from the start to prevent any budget overruns or project delays. The parameters that need to be considered for cost control effectiveness are parameters that can affect quality and effectiveness related to good cost control. The better the control, the higher the quality and effectiveness of a project. To determine the scoring of the parameters of control effectiveness can be calculated:

a) Time Parameter Analysis

Time to complete the work according to plan or deviation minus (-) or plus (+) for each week. From the Schedule Performance Index (SPI) table the results are obtained:

- Total data = 24 weeks
- Result > 1 = 11 weeks
- Result < 1 = 13 weeks
- Expected score = 0.90

$$\begin{aligned} \text{Cost-effectiveness obtained} &= \frac{11}{13} = 0,84 \\ &= 0,84 \times 0,9 = 0,761 \end{aligned}$$

Control Effectiveness	Parameter	Score
Time	To complete the work according to the plan	0,761

The project's cost and time control effectiveness is measured by the score obtained from the parameters mentioned above.

- Parameter results for the schedule have a score value of 0.76 meaning that the work is progressing from the planned schedule.
- The relationship between the two cost and time parameters above is that the work is faster at a cost greater than the budget.

- a) Effectiveness < 1: Less Effective
- b) Effectiveness = 1: Effective
- c) Effectiveness > 1: Highly Effective

Therefore, the parameter results above can be calculated using the following formula:

$$\begin{aligned}\text{Effectiveness} &= \frac{\text{Expected results} - \text{Worst results}}{\text{Best result} - \text{Worst result}} \\ &= \frac{0,9 - 0,1}{1,26 - 0,761} \\ &= 1,603\end{aligned}$$

From the above calculations, an effectiveness value of 1.603 is obtained for controlling project costs and time using the Earned Value method. In other words, the effectiveness value is greater than 1 (one), hence controlling the Bagor Bridge Replacement project in Situbondo Regency is very effective using the Earned Value method.

4. Conclusion

Based on the study of time performance on the Situbondo Regency Bagor Bridge Replacement project, the performance of project implementation time in weeks 2, 4, 5, 9, 11, 13, 16, 17, 18, 20, 21, 24 is slower than the plan schedule, this is indicated from the Schedule Variant (SV) indicator. While the performance of the project implementation time in week 3, 6, 7, 8, 10, 12, 14, 15, 19, 22 is faster than the plan schedule, this is shown by the positive value Schedule Variant (SV).

There are several suggestions that need to be considered. First, for the implementing contractor should make a complete daily project report where the report can explain how much value is spent by the project so that the contractor can see how much swelling and savings that occur on the project, in order to anticipate the risks that exist next. Second, the Earned Value Concept method is very appropriate to monitor the course of the project as a whole and can be combined with other methods that function to monitor the course of the project so that the use of time and costs can be directed. Lastly, to prevent cost and time overruns, we must always pay attention to several important factors including logistics management, equipment management, and resource management to avoid unexpected problems.

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