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Cost and Time Control in Bunglai Road Reconstruction Project Using Microsoft Project Based on Earned Value Method

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A B S T R A C T

During implementation, the Bunglai Road Reconstruction Project experienced delays in completing several work items, with actual progress not matching the planned baseline schedule. Factors contributing to delays included limited heavy equipment experiencing mechanical breakdowns, extreme weather conditions, and challenging mountainous terrain. Therefore, improved schedule management and cost control were required using Microsoft Project software based on the Earned Value Method (EVM). This cost and time management aims to enhance project execution efficiency and effectiveness within budget and time constraints. In this study, analyzed data included planned baseline data (RAB, S-Curve, baseline schedule), actual physical and cost data (ACWP, BCWP, BCWS), and a rescheduling scenario. The results indicated that rescheduling successfully accelerated project completion from the original estimate of January 2026 (Week 19) to November 2025 (Week 14). EVM analysis on actual data revealed significant middle-phase delays with cost overruns from Week 11, and Week 13 to Week 17. However, after implementing the rescheduling strategy, cost and schedule variances were optimized, confining cost overruns to only the first week and maintaining favorable cost and schedule performance indices (CPI > 1 and SPI > 1) for the remainder of the project

INTRODUCTION

Roads are one of the land transportation infrastructure that plays a crucial role in supporting community movement, economic growth, and regional logistics distribution. The existence of a steady and safe road network not only increases the speed of user mobilization, but must also guarantee aspects of comfort, accessibility, and traffic safety. The better the technical quality of the road network, the higher the level of comfort and safety felt by road users.

The Bunglai Road Reconstruction Package Project, located in Bunglai Village, Aranio District, Banjar Regency, South Kalimantan Province, is the result of a review of the handling of the Banjarbaru – Batulicin Alternative Road by the Public Works and Spatial Planning Office (PUPR) of the South Kalimantan Provincial Government. The main purpose of this reconstruction project is to improve one of the three accident-prone points (black spots) because the horizontal alignment is in the form of a curve geometry that is too sharp and the vertical alignment with a very steep mountain slope, so it is considered very dangerous to the safety of road users.

However, in its implementation practice in the field, the Bunglai Road Reconstruction Project experienced significant delays in several main work items. Actual physical progress is not able to keep up with the target on the baseline schedule. Work items that experienced serious delays include work in Division 3 (Earthworks and Geosynthetics) including Ordinary Excavation, Stone Excavation, Ordinary Accumulation of Excavated Products, and Division 5 (Granular Pavement and Cement Concrete Pavement), especially Class B Aggregate Foundation Layers.) which resulted in volume adjustments and budget diversion, such as financing for the Drainage Sewer Excavation, DS 5 U-Ditch Channel, and Concrete fc' 10 MPa which were partially diverted to cover the surge in the volume of Rock Excavation work due to the real condition of the rocks in the field.

The main factors triggering the delay include the limited allocation of heavy equipment units in the field which often experience mechanical damage (trouble/breakdown) so that it requires a duration of several days for repairs, high rainfall weather factors that hinder excavation and soil compaction activities, and very extreme terrain topographic conditions where the road footprint is located on two steep mountain slopes. Delays in activities on critical project trajectories have a direct impact on the decline in time performance and risk inflating overhead costs as well as overall project operational costs.

In order to anticipate the impact of widespread delays, integrated, responsive, and measurable project management control instruments are needed. The integration of Microsoft Project software for critical trajectory simulation and rescheduling with the implementation of the Earned Value Method (EVM) concept offers a comprehensive solution. EVM integrates the three main dimensions of project management—physical achievement (scope/progress), time schedule, and actual cost realization—into quantitative indicators that are able to detect performance irregularities early and predict estimated total cost (EAC) and project completion time (TE).

This study aims to: (1) Analyze and compile project time control simulations using Microsoft Project through rescheduling scenarios based on critical trajectory analysis; and (2) Analyze and estimate cost and time performance indicators in the Bunglai Road Reconstruction Project using the Earned Value Method to realize budget efficiency and timeliness of completion.

LITERATURE REVIEW

Construction Project Control

Project control is a systematic methodology used to collect, record, analyze, and distribute schedule, financial, and scope data to support a measurable and timely management decision-making process (Wijaksana et al., 2012; Castollani et al., 2020). Time control is the process of monitoring the progress of project activities, comparing actual progress to the initial plan, and identifying schedule variances as early as possible so that corrective actions can be implemented immediately (Sari & Salasa, 2023). According to Priyo (2012) and Rizal et al. (2025), construction project control includes four main pillars:

Cost Control: Ensuring that the entire series of work is carried out according to the approved budget limit through continuous financing data analysis.

1. Schedule Control: Controls the duration of the implementation of each activity item so that the final completion of the project is within the contract time target.
2. Material and Tool Control (Resource Control): Regulating the supply chain of building materials and the efficiency of heavy equipment utilization so as not to cause delays.
3. Quality Control: Ensure that the work results meet the technical specifications and quality standards set out in the contract documents.

Microsoft Project Applications and Critical Paths

Microsoft Project is a leading project management software designed to help with planning, resource allocation, progress tracking, workload analysis, and budget management dynamically (Fakhriani, 2025). One of the main advantages of this software is its ability to identify Critical Path Method (CPM) or critical trajectories—that is, a sequence of interdependent activities that has a total grace period (float/slack) of zero. Work that is on a critical track should not experience the slightest delay, because a one-day delay in critical activities will immediately shift the final completion date of the entire project.

The Concept of the Earned Value Method

The Earned Value Method (EVM) or Yield Value Concept is a management technique that combines quantitative measurement of the actual volume of work that has been completed (earned value) with planned value and realization of financial expenditure (Maromi & Indryani, 2015). The EVM concept uses three basic indicators as an analytical reference:

Budgeted Cost of Work Scheduled (BCWS): The planned budget value for a package of work scheduled to be completed up to a specified period.

$$BCWS = \% \text{ Rencana} \times \text{Nilai Kontrak (BAC)} \quad (1)$$

Budgeted Cost of Work Performed (BCWP): The value of the results or budget portion of physical work that has actually been completed in the field during the review period (earned value).

$$BCWP = \% \text{ Realisasi Physical} \times \text{Nilai Kontrak (BAC)} \quad (2)$$

Actual Cost of Work Performed (ACWP): The actual expenses or expenses that are actually incurred and recorded to complete physical work during the review period.

From the three main indicators above, the magnitude of deviations/variances in cost and time performance is calculated (Pradita & Simanjuntak, 2023):

$$\text{Cost Variance (CV)} = BCWP - ACWP \quad (3)$$

$$\text{Schedule Variance (SV)} = BCWP - \quad (4)$$

The level of budget use efficiency and timeliness is measured through the Performance Index ratio (Performance
Index):

$$\text{Cost Performance Index (CPI)} = BCWP / \quad (5)$$

$$\text{Schedule Performance Index (SPI)} = BCWP / \quad (6)$$

The interpretation criteria for index values are as follows:

1. CPI = 1.0 or SPI = 1.0: Expenses or time duration are exactly as planned.
2. CPI > 1.0 or SPI > 1.0: Expenses are more economical than budget (under budget) / implementation ahead of schedule.
3. CPI < 1.0 or SPI < 1.0: Over budget expenses / behind schedule.

EVM also allows for estimation of total residual costs (ETC), estimated total final costs (EAC), and predictions of total project completion time (TE) (Juliana, 2016; Dwitanto et al., 2017):

Estimated Cost of Work Remaining (Estimate to Complete / ETC):

$$\text{For } 50\% < \text{progress: } ETC = BAC - BCWP(\quad 7)$$

$$EAC = ACWP + ETC \quad (9)$$

Estimated Total Final Cost of the Project (*EAC*):

Estimated Total Project Completion Time (*TE):*

$$TE = \text{Time Exceeded} + (\text{Time Remaining} / SPI) \quad (10)$$

METHODOLOGY

Project Location and General Data

This research focuses on the object of study on the regional animal husbandry infrastructure project, namely the Bunglai Road Reconstruction Package Project which is strategically located in Bunglai Village, Aranio District, Banjar Regency, South Kalimantan Province. The administrative characteristics and details of the project contract are presented in the following description:

a. Project Name: Bunglai Road Reconstruction Package
b. Contract Number: 000.3/1371.1/BM.1718.BE/PUPR/2025
c. Contract Value (BAC): IDR 23,078,572,561.50 (including 11% VAT)
d. Source of Funds: South Kalimantan Provincial Budget for Fiscal Year 2025
e. Project Owner: South Kalimantan Provincial Government c.q. PUPR Office for Highways
f. Implementing Contractor: PT. Bimo Laksana Group
g. Supervisory Consultant: CV. Arsa Eight
h. Contract Execution Time: 180 Calendar Days (August 2025 – January 2026 / 19 Weeks)
i. Maintenance Time: 360 Calendar Days

Data Types and Data Collection

The data collection method is carried out through a secondary document study approach that is sourced directly from the implementing contractor PT. Bimo Laksana Group and supervisory consultant CV. Arsa Dewapan. Secondary data collected include:

1. Cost Budget Plan (RAB) Document Field Planning and Engineering (CCO).
2. Work Implementation Plan Schedule (Baseline Time Schedule) and Plan S Curve.
3. Weekly Report and Monthly Project Progress Report (Physical Progress of Realization).
4. Field Actual Payment and Cost Recapitulation Report (ACWP).

Stages of Data Analysis

The systematic system of research data processing is carried out in order as follows:

- Microsoft Project Baseline Compilation: Enter data on work breakdown structure (WBS), volume, duration, and inter-activity relationships (predecessor/successor) to form a Gantt Chart plan.
- EVM Basic Indicator Calculation: Calculates weekly quantitative values for BCWS, BCWP, and ACWP from week 1 to week 19.
- Analysis of Variance and Realization Performance Index: Calculate the value of cost variance (CV), schedule variance (SV), cost performance index (CPI), and schedule performance index (SPI) realization.
- Rescheduling Scenario Formulation: Rescheduling Microsoft Projects by optimizing critical trajectory duration, efficiency of adding machine allocations, and rearranging work sequences.

EVM Reschedule & Forecasting Analysis: Recalculate EVM indicators of reschedule scenarios and project estimated residual costs (ETC), estimated total costs (EAC), and estimated total duration (TE).

RESULTS

Budgeting, Cost Plans, and Baseline Scheduling

Based on the initial contract Cost Budget Plan (RAB) document, the total project budget is IDR 23,078,572,561.50. The project is divided into 5 main divisions of work with the structure of the activity weight presented in Table 1.

Table 1. Cost Budget Plan (RAB) and Baseline Weights

NO. DIVIDED	JOB DESCRIPTION / DIVISION	TOTAL PRICE (RP)	WEIGHT (%)
DIVISION 1	General (Mobilization, K3 Train, Operational)	IDR 30,435,000,00	0,13%
DIVISION 2	Drainage (Sewer Excavation, DS 5 U-Ditch Channel)	IDR 1,906,420,173,64	8,26%
DIVISION 3	Earthworks and Geosynthetics (Ordinary Excavation, Stone, Landfill, Geotextiles)	IDR 18,506,138,355,00	80,19%
DIVISION 5	Granular pavement (grade B aggregate foundation layer)	IDR 2,381,137,500,00	10,32%
DIVISION 7	Structure (concrete fc' 10 MPa)	IDR 254,341,532,85	1,10%
TOTAL CONTRACT COST (BAC)		**IDR 23,078,572,561,50**	**100,00%**

The baseline scheduling compiled in *Microsoft Project* sets a total duration of 126 business days (180 calendar days / 19 weeks), starting in mid-August 2025 and targeted for completion in the first week of January 2026. The critical trajectory analysis of the plan identified 4 main work items on the critical trajectory (*Critical Path*), namely: Division 1 Initial & Final Mobilization, K3, Division 3 Ordinary Excavation, Stone Excavation, and Division 5 Layer Class B Aggregate Foundation.

Realization of Project Delay Implementation and Evaluation

Entering the field implementation stage, the real physical progress is significantly behind the planned schedule. In the middle of the contract period (weeks 8 to 14), the delay peaked due to operational obstacles in excavating mountain rock and the limited capacity of the excavator unit. The monthly report notes that the cumulative progress of realization in the 13th week has only reached 60.10%, while the cumulative target of the plan reached 80.71% (there is a negative deviation of -20.61%).

Results of Analysis of the Concept of Value of Results (EVM) Realization

The calculation of weekly BCWS, BCWP, and ACWP values is calculated based on the cumulative progress of the plan and actual realization. The recapitulation of the results of the realization EVM analysis for the 19-week review period is presented in Table 2.

Table 2. Recapitulation of Outcome Value Indicators (BCWS, BCWP, ACWP) Realizationi

WEEK 1	PLAN WEIGHT (%)	REALIZATION WEIGHT (%)	BCWS (RP)	BCWP (RP)	ACWP (RP)
1	1,54%	3,14%	355.410.017,45	724.667.178,43	350.609.873,27
2	7,55%	6,27%	1.742.432.228,39	1.447.026.499,61	701.219.746,54
3	13,56%	9,41%	3.129.454.439,34	2.171.693.678,04	1.051.829.619,81
4	19,57%	12,55%	4.516.476.650,29	2.896.360.856,47	1.081.264.436,38
5	24,09%	15,69%	5.559.628.130,07	3.621.028.034,90	2.162.528.872,76
6	30,54%	18,82%	7.048.196.060,28	4.343.387.356,07	3.243.793.309,14
7	37,00%	21,96%	8.539.071.847,76	5.068.054.534,51	4.325.057.745,52
8	43,46%	27,27%	10.029.947.635,23	6.293.526.737,52	4.671.308.112,62
9	49,92%	32,57%	11.520.823.422,70	7.516.691.083,28	7.006.962.168,93
10	56,66%	40,95%	13.076.319.213,35	9.450.675.463,93	9.342.616.225,24
11	64,68%	49,33%	14.927.220.732,78	11.384.659.844,59	11.678.270.281,55
12	72,70%	54,71%	16.778.122.252,21	12.626.287.048,40	12.469.773.252,72
13	80,71%	60,10%	18.626.715.914,39	13.870.222.109,46	14.548.068.794,84
14	86,79%	65,49%	20.029.893.126,13	15.114.157.170,53	16.626.364.336,96
15	88,35%	70,88%	20.389.918.858,09	16.358.092.231,59	17.665.512.108,02
16	89,63%	76,18%	20.685.324.586,87	17.581.256.577,35	18.704.659.879,08
17	94,79%	81,49%	21.876.178.931,05	18.806.728.780,37	20.782.955.421,20
18	99,99%	100,00%	23.076.264.704,24	23.078.572.561,50	22.861.250.963,32
19	99,99%	100,00%	23.076.264.704,24	23.078.572.561,50	23.078.572.561,50

An example of the mathematical calculation of the EVM indicator in Week 1 is as follows:

BCWS = 1,54% × Rp 23.078.572.561,50 = Rp 355.410.017,45

BCWP = 3,14% × Rp 23.078.572.561,50 = Rp 724.667.178,43

ACWP = IDR 350,609,873.27 (recording of actual cost reports)

1. Analysis of Variance and Realization Performance Index

Based on the basic indicators above, the evaluation of variance (CV, SV) and performance index (CPI, SPI) realization is calculated to monitor the daily performance of the project. The recapitulation is presented in Table 3.

Table 3. Recapitulation of Cost Variance, Schedule, CPI, and SPI Realization

WEEK 1	COST VARIANCE / CV (RP)	SCHEDULE VARIANCE / SV (RP)	CPI	SPI	PERFORMANCE DESCRIPTION
1	IDR 374,057,305,16	IDR 369,257,160,98	2,07	2,04	Economical & Fast
2	IDR 745,806,753,07	-IDR 295,405,728.79	2,06	0,83	Save, Late
3	IDR 1,119,864,058,23	-IDR 957,760,761,30	2,06	0,69	Save, Late
4	IDR 1,815,096,420,09	-IDR 1,620,115,793.82	2,68	0,64	Save, Late
5	IDR 1,458,499,162,14	-IDR 1,938,600,095.17	1,67	0,65	Save, Late
6	IDR 1,099,594,046,93	-IDR 2,704,808,704,21	1,34	0,62	Save, Late
7	IDR 742,996,788,99	-IDR 3,471,017,313,25	1,17	0,59	Economical, Critical Delays
8	IDR 1,622,218,624,90	-IDR 3,736,420,897.71	1,35	0,63	Economical, Critical Delays
9	IDR 509,728,914,35	-IDR 4,004,132,339.42	1,07	0,65	Save, Late
10	IDR 108,059,238,69	-IDR 3,625,643,749.41	1,01	0,72	On Budget, Late
11	-IDR 293,610,436,96	-IDR 3,542,560,888.19	0,97	0,76	Over budget, Late
12	IDR 156,513,795.68	-IDR 4,151,835,203.81	1,01	0,75	Save, Late
13	-IDR 677,846,685.38	-IDR 4,756,493,804.93	0,95	0,74	Over budget, Late
14	-IDR 1,512,207,166.43	-IDR 4,915,735,955.60	0,91	0,75	Over budget, Late
15	-IDR 1,307,419,876.43	-IDR 4,031,826,626,49	0,93	0,80	Over budget, Late
16	-IDR 1,123,403,301.73	-IDR 3,104,068,009,52	0,94	0,85	Over budget, Late
17	-IDR 1,976,226,640.83	-IDR 3,069,450,150.68	0,90	0,86	Maximum Wasteful, Late
18	IDR 217,321,598,18	IDR 2,307,857,26	1,01	1,00	Achieved 100% as planned
19	IDR 0,00	IDR 2,307,857,26	1,00	1,00	Completed According to the Contract

The analysis of the data in Table 3 shows the critical dynamics of project implementation:

1. Time Performance (SPI): From week 2 to week 17, the SPI value < 1.0 consistently. The lowest value occurred in week 7 (SPI = 0.59) with a Schedule Variance of -Rp 3.47 Billion. This shows severe physical delays in the excavation work of soil and aggregate pavement.
2. Cost Performance (CPI): In weeks 1 to 10, the project shows a cost efficiency level (CPI > 1.0). But starting in week 11 and continuing in week 13 to week 17, the CPI value < 1.0 (with a range of 0.90 – 0.97). The main causes of these cost losses are high idle heavy equipment rental expenses and unstructured partial acceleration in the field. The peak of cost overruns occurred in the 17th week with a Cost Variance value of -IDR 1,976,226,640.83.

Estimated Final Cost (EAC) and Completion Duration (TE) of Realization Estimated residual costs (ETC) and estimated total final costs (EAC) are calculated weekly to predict financial risk until the project is completed. The results of the formulation are presented in Table 4.

Table 4. Summary of Estimated Residual Cost (ETC) and Total Final Cost (EAC) Realized

WEEK 1	FORMULATION METHODS ETC	ESTIMATED RESIDUAL COSTS / ETC (RP)	ESTIMATED TOTAL COST / EAC (RP)
1	ETC = BAC − BCWP (Progress < 50%)	IDR 22,353,905,383,07	IDR 22,704,515,256,34
2	ETC = BAC − BCWP (Progress < 50%)	IDR 21,631,546,061,89	IDR 22,332,765,808,43
3	ETC = BAC − BCWP (Progress < 50%)	IDR 20,906,878,883,46	IDR 21,958,708,503,27
4	ETC = BAC − BCWP (Progress < 50%)	IDR 20,182,211,705,03	IDR 21,263,476,141,41
5	ETC = BAC − BCWP (Progress < 50%)	IDR 19,457,544,526,60	IDR 21,620,073,399,36
WEEK 1	FORMULATION METHODS ETC	ESTIMATED RESIDUAL COSTS / ETC (RP)	ESTIMATED TOTAL COST / EAC (RP)
6	ETC = BAC − BCWP (Progress < 50%)	IDR 18,735,185,205,43	IDR 21,978,978,514,57
7	ETC = BAC −	IDR 18,010,518,026,99	IDR

	BCWP (Progress < 50%)		22,335,575,772,51
8	ETC = BAC − BCWP (Progress < 50%)	IDR 16,785,045,823,98	IDR 21,456,353,936,60
9	ETC = BAC − BCWP (Progress < 50%)	IDR 15,561,881,478,22	IDR 22,568,843,647,15
10	ETC = BAC − BCWP (Progress < 50%)	IDR 13,627,897,097,57	IDR 22,970,513,322,81
11	ETC = BAC − BCWP (Progress < 50%)	IDR 11,693,912,716,91	IDR 23,372,182,998,46
12	ETC = (BAC − BCWP) / CPI (Progress > 50%)	IDR 10,452,285,513,10	IDR 22,922,058,765,82
13	ETC = (BAC − BCWP) / CPI (Progress > 50%)	IDR 9,208,350,452,04	IDR 23,756,419,246,88
14	ETC = (BAC − BCWP) / CPI (Progress > 50%)	IDR 7,964,415,390,97	IDR 24,590,779,727,93
15	ETC = (BAC − BCWP) / CPI (Progress > 50%)	IDR 6,720,480,329,91	IDR 24,385,992,437,93
16	ETC = (BAC − BCWP) / CPI (Progress > 50%)	IDR 5,497,315,984,15	IDR 24,201,975,863,23
17	ETC = (BAC − BCWP) / CPI (Progress > 50%)	IDR 4,271,843,781,13	IDR 25,054,799,202,33
18	100% Progress Complete	IDR 0,00	IDR 22,861,250,963,32
19	Final Contract Settlement	IDR 0,00	IDR 23,078,572,561,50

Example of estimated cost calculation in Week 17 (where cumulative physical progress > 50%):

ETC = (BAC – BCWP) / CPI = (23.078.572.561,50 – 18.806.728.780,37) / 0,90 = Rp 4.271.843.781,13

EAC = ACWP + ETC = Rp 20.782.955.421,20 + Rp 4.271.843.781,13 = Rp 25.054.799.202,33

The calculation above shows a real risk if management improvements are not made: in week 17, the project is projected to swell to Rp 25.05 billion (experiencing a potential swell of Rp 1.97 billion from BAC). The calculation of

the Time Estimate (TE) in the worst conditions (7th week) also shows a potential delay of up to 24 weeks (exceeding the 19-week contract limit).

Rescheduling Scenarios Using Microsoft Project

Considering the risk of delays and cost overruns, management actions in the form of rescheduling scenarios are prepared in Microsoft *Project*. The *rescheduling strategy* is carried out on the principle:

1. Cutting and condensing the duration (*crashing schedule*) on activities that hold critical track paths through the addition of night shift allocation and the addition of 2 units of heavy-duty excavators.
2. Changing the relationship between activities from a serial relationship to a precedent overlapping relationship (*Fast Tracking*) such as the implementation of *Start-to-Start* (SS) with a lag.

Reducing the critical trajectory of the project from the original 4 jobs to 3 critical jobs, namely focused on Division 1: Initial Mobilization, Final Mobilization, and K3 Continuity.

The results of the *rescheduling* simulation in *Microsoft Project* significantly reduced the duration of project completion from 126 working days to only 90 working days (14 calendar weeks). With this scenario, the project completion schedule, which was originally threatened to be delayed until January 2026, has been successfully advanced to completion in mid-November 2025.

1. Analysis of EVM Evaluation Results for Reschedule Scenario

After the *rescheduling* scenario is implemented, all EVM indicators, variances, performance indices, and residual cost predictions are recalculated. The recapitulation of EVM indicators in *the reschedule* scenario is presented in Table 5.

Table 5. Recapitulation of EVM Result Indicator Reschedule Scenario

MINGGU KE-	BOBOT KUM. RESCHEDULE (%)	BCWS (RP)	BCWP RESCHEDULE (RP)	ACWP (RP)
1	0,04%	355.410.017,45	9.231.429,02	350.609.873,27
2	11,37%	1.742.432.228,39	2.624.033.700,24	701.219.746,54
3	16,71%	3.129.454.439,34	3.856.429.475,03	1.051.829.619,81
4	22,04%	4.518.784.507,54	5.086.517.392,55	1.081.264.436,38
5	27,37%	5.559.628.130,07	6.316.605.310,08	2.162.528.872,76
6	32,70%	7.050.503.917,54	7.546.693.227,61	3.243.793.309,14
7	38,04%	8.541.379.705,01	8.779.089.002,39	4.325.057.745,52
8	43,37%	10.029.947.635,23	10.009.176.919,92	4.671.308.112,62
9	53,16%	11.520.823.422,70	12.268.569.173,69	7.006.962.168,93
10	62,96%	13.078.627.070,60	14.530.269.284,72	9.342.616.225,24

11	75,83%	14.929.528.590,03	17.500.481.573,39	11.678.270.281,55
12	89,63%	16.780.430.109,47	20.685.324.586,87	12.469.773.252,72
13	99,96%	18.629.023.771,64	23.069.341.132,48	14.548.068.794,84
14	100,00%	20.032.200.983,38	23.078.572.561,50	16.626.364.336,96
15	100,00%	20.392.226.715,34	23.078.572.561,50	17.665.512.108,02
16	100,00%	20.687.632.444,13	23.078.572.561,50	18.704.659.879,08
17	100,00%	21.878.486.788,30	23.078.572.561,50	20.782.955.421,20
18	100,00%	23.078.572.561,50	23.078.572.561,50	22.861.250.963,32
19	100,00%	23.078.572.561,50	23.078.572.561,50	23.078.572.561,50

Furthermore, the results of the calculation of variance (CV, SV) and performance index (CPI, SPI) after *rescheduling* are presented on Table 6.

Table 6. Recap of Variance and Post-Rescheduling Performance Index

WEEK 1	CV RESCHEDULE (RP)	SV RESCHEDULE (RP)	CPI	SPI	RESCHEDULE PERFORMANCE STATUS
1	-IDR 341,378,444.25	-IDR 346,178,588.42	0,03	0,03	The Beginning of the Reschedule Mobilization
2	IDR 1,922,813,953,70	IDR 881,601,471,85	3,74	1,51	Very Economical & Very Fast
3	IDR 2,804,599,855,22	IDR 726,975,035.69	3,67	1,23	Very Economical & Fast
4	IDR 4,005,252,956,17	IDR 567,732,885,01	4,70	1,13	Very Economical & Fast
WEEK 1	CV RESCHEDULE (RP)	SV RESCHEDULE (RP)	CPI	SPI	RESCHEDULE PERFORMANCE STATUS
5	IDR 4,154,076,437,32	IDR 756.977.180.02	2,92	1,14	Very Economical & Fast
6	IDR 4,302,899,918,47	IDR 496,189,310,07	2,33	1,07	Economical & Fast
7	IDR 4,454,031,256,87	IDR 237,709,297,38	2,03	1,03	Economical & Fast
8	IDR 5,337,868,807,30	-IDR 20,770,715.31	2,14	1,00	Economical & Punctual
9	IDR 5,261,607,004,76	IDR 747,745,750,99	1,75	1,06	Economical & Fast
10	IDR 5,187,653,059,48	IDR 1,451,642,214,12	1,56	1,11	Economical & Fast
11	IDR 5,822,211,291,84	IDR 2,570,952,983,35	1,50	1,17	Very Economical & Fast

12	IDR 8,215,551,334,15	IDR 3,904,894,477,41	1,66	1,23	Very Economical & Fast
13	IDR 8,521,272,337,64	IDR 4,440,317,360,83	1,59	1,24	Close to 100% Finished
14	IDR 6,452,208,224,54	IDR 3,046,371,578,12	1,39	1,15	100% Physical Progress Completed
15	IDR 5,413,060,453,48	IDR 2,686,345,846,16	1,31	1,13	Maintenance / Demobilization
16	IDR 4,373,912,682,42	IDR 2,390,940,117,37	1,23	1,12	Maintenance / Demobilization
17	IDR 2,295,617,140,30	IDR 1,200,085,773,20	1,11	1,05	Maintenance / Demobilization
18	IDR 217,321,598,18	IDR 0,00	1,01	1,00	Administrative Final
19	IDR 0,00	IDR 0,00	1,00	1,00	Perfect Finish

Table 6 demonstrates the advantages of the rescheduling scenario.

From Week 2 until all physical work was 100% complete in Week 14, the Cost Performance Index (CPI) ranged from 1.39 to 3.74 (CPI > 1.0) and the Schedule Performance Index (SPI) ranged from 1.00 to 1.51 (SPI ≥ 1.0). This indicates that the project is proceeding well within budget and, in terms of physical progress, is moving faster than the new time target.

Estimated Remaining Cost (ETC) and Estimated Total Cost (EAC) Results After Rescheduling

The calculations for the estimated remaining cost (ETC) and estimated final cost (EAC) after applying the rescheduling scenario are presented in Table 7.

Table 7. Summary of ETC and EAC Cost Estimates After Rescheduling

WEEK 1	ESTIMATED RESIDUAL COSTS / ETC (RP)	ESTIMATED TOTAL COST / EAC (RP)	DIFFERENCE IN COST PERFORMANCE TO BAC
1	IDR 23,069,341,132,48	IDR 23,419,951,005,75	Awal Reschedule
2	IDR 20,454,538,861,26	IDR 21,155,758,607,80	Efficiency IDR 1.92 Billion
3	IDR 19,222,143,086,47	IDR 20,273,972,706,28	Efficiency IDR 2.80 Billion
4	IDR 17,992,055,168,95	IDR 19,073,319,605,33	Efficiency IDR 4.00 Billion
5	IDR 16,761,967,251,42	IDR 18,924,496,124,18	Efficiency IDR 4.15 Billion
6	IDR 15,531,879,333,89	IDR 18,775,672,643,03	Efficiency IDR 4.30 Billion
7	IDR 14,299,483,559,11	IDR 18,624,541,304,63	Efficiency IDR 4.45 Billion

8	IDR 6,099,519,908,18	IDR 10,770,828,020,80	Maximum Tool Efficiency
9	IDR 6,173,929,796,70	IDR 13,180,891,965,63	Very Economical
10	IDR 5,496,354,907,61	IDR 14,838,971,132,85	Very Economical
11	IDR 3,722,323,522,42	IDR 15,400,593,803,97	Very Economical
12	IDR 1,442,726,192,47	IDR 13,912,499,445,19	Very Economical
13	IDR 5,821,556,14	IDR 14,553,890,350,98	Almost 100% Physical Work
14	IDR 0,00	IDR 16,626,364,336,96	Physical Progress 100% Complete
15	IDR 0,00	IDR 17,665,512,108,02	Administrative Completion
16	IDR 0,00	IDR 18,704,659,879,08	Administrative Completion
17	IDR 0,00	IDR 20,782,955,421,20	Administrative Completion
18	IDR 0,00	IDR 22,861,250,963,32	Financial Finalization
19	IDR 0,00	IDR 23,078,572,561,50	Completed in accordance with BAC Contract

As listed in Table 7, the estimated cost for remaining work (ETC) managed to touch the value of Rp 0.00 in week 14. This shows an acceleration 4 weeks earlier than the initial scheduling conditions where the ETC value only touched Rp 0.00 in the 18th week.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the analysis, data processing, and discussion presented in the previous chapters, the following key conclusions can be drawn:

1. Project schedule management using Microsoft Project through a rescheduling scenario proved effective in addressing delays in the Bunglai Road Reconstruction Project. The rescheduling successfully reduced the duration of physical work from the original estimated completion date of January 2026 (week 19) to November 2025 (week 14). Additionally, the rescheduling scenario successfully optimized the project's critical path from 4 major work items to just 3 critical work items in Division 1 (General: Initial Mobilization, Final Mobilization, and K3 Kontren), thereby minimizing the risk of cascading delays on-site.
2. Cost and schedule control based on the Earned Value Method (EVM) was able to accurately identify critical points of cost and schedule deviations. An analysis of actual performance prior to rescheduling revealed cost overruns (over budget) in weeks 11, 13, and 17, with the worst Cost Variance reaching -Rp 1.97 billion in week 17. However, after rescheduling, cost overruns were successfully curbed and occurred only during the first week of implementation; in subsequent weeks, cost and schedule performance remained in excellent condition (CPI > 1.0 and SPI ≥ 1.0). However, after

rescheduling, cost overruns were successfully minimized and occurred only during the first week of implementation; in the subsequent weeks, cost and schedule performance remained in excellent condition (CPI > 1.0 and SPI ≥ 1.0). The estimated remaining cost (ETC) reached Rp 0.00 four weeks earlier (week 14) than originally scheduled (week 18).

Recommendation

Based on the results of the research evaluation, several technical and operational recommendations are suggested for the implementation of similar projects in the future:

The contractor is advised to implement a system for adding overtime hours and to provide standby heavy equipment from the start of the project period for earth and rock excavation work in hilly terrain prone to weather-related delays.

The use of a combination of Microsoft Project software and the Earned Value Method should be adopted as the standard for monthly reporting and monitoring by the supervising consultant and the relevant agency (owner) to detect cost and schedule variances as early as possible before irreversible delays occur.

REFERENCES

Castollani, A., Puro, S., & Dewa, M. L. (2020). Analisis Biaya dan Waktu pada Proyek Apartemen Dengan Metode Earned Value Concept.

Dwitanto, M., Mulyani, R. E., & Nuh, S. M. (2017). Penerapan Konsep Nilai Hasil pada Proyek Pembangunan Gedung di Kota Pontianak (Studi Kasus pada Proyek Pembangunan Ruko 4 Lantai di Jalan Pangeran Natakusuma, Pontianak). Jurnal Sipil Universitas Tanjungpura, 5(2), 112–124.

Fakhriani, A. (2025). Simulasi Penjadwalan Pembangunan Jembatan Mantuil 09 Akibat Adanya Keterlambatan Pekerjaan dengan Menggunakan Microsoft Project. Skripsi Tugas Akhir, Jurusan Teknik Sipil dan Kebumian, Politeknik Negeri Banjarmasin, Banjarmasin.

Juliana, R. (2016). Pengendalian Biaya dan Waktu Pelaksanaan Proyek Konstruksi dengan Metode Earned Value Analysis. Jurnal Teknik Sipil dan Infrastruktur, 4(1), 25–34.

Jurnal Rekayasa Konstruksi Mekanika Sipil, 3(1), 39–48.

Maromi, M. I., & Indryani, R. (2015). Penerapan Konsep Earned Value pada Proyek Pembangunan Infrastruktur Jalan Raya. Jurnal Teknik ITS, 4(2), C140–C145.

Pradita, D., & Simanjuntak, M. R. (2023). Analisis Estimasi Penyelesaian Proyek Konstruksi terhadap Waktu dan Biaya. Seminar Nasional Rekayasa, Sains dan Teknologi (SATIESP), Vol. 2 No. 1, 88–96.

Priyo, M. (2012). Manajemen Konstruksi dan Pengendalian Proyek Infrastruktur. Yogyakarta: LP3M Universitas Muhammadiyah Yogyakarta.

Rizal, A. H., Toja, R., & Nasjono, J. K. (2025). Pengendalian Biaya dengan Earned-Value-Method pada Proyek Pembangunan dan Rehabilitasi Seminari Bunda Segala Bangsa Maumere. Jurnal Teknik Sipil Utamaro, 14(1), 45–56.

Sari, D. P., & Salasa, S. B. (2023). Pengendalian Waktu dan Biaya dengan Metode Earned Value Analysis (Studi Kasus: Rekonstruksi Jalan Kabupaten Kutai Kartanegara). Jurnal Rekayasa Sipil Kaltim, 7(2), 315–319.

Wijaksana, A., Dipohusodo, I., & Soeharto, I. (2012). Manajemen Proyek: Dari Konseptual Sampai Operasional. Jakarta: Erlangga.