ANALYSIS OF TIME AND COST CONTROL USING THE EARNED VALUE METHOD IN WELL PAD HILLING AND COMPACTING WORK IN THE PT. PERTAMINA HULU ROKAN RIAU PROVINCE

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ABSTRACT

KEYWORDS
Cost, Earned
Value Method,
Result Value,
Scheduling, Time

The development of physical facilities in Indonesia is increasing rapidly along with the promotion of modernization. In the implementation of a project it is very rare to find a project that goes exactly as planned. Generally, they experience delays from what was planned, both in terms of time and progress of work, but there are also projects that experience acceleration from the initial schedule planned. The research objectives were to determine time and cost performance, and to determine cost estimates and final project completion time for the Well Pad stockpiling and compaction project in the Rokan Riau Oil and Gas Block environment. The method used in this study is the Earned Value method which combines the elements of cost and time as well as the physical performance of the work. The data obtained from the project includes the project time schedule, budget plan (RAB), project weekly reports and actual costs, then an analysis of costs, schedules, variances and performance indexes is carried out by explaining the problems that arise during the research. Based on the results of the analysis and discussion, the calculation of the CPI value is> 1 from the 1st week to the 16th week. This means that from the 1st week to the 16th week, the project cost is more economical. The EAS calculation for the 16th week estimates the project completion time is 116 days or 16 weeks. This means that the project is experiencing a delay from the planned schedule. At the end of the review period, an estimated final project cost of Rp. 4,022,024,000.00. And the estimated time for project completion is 116 days, which means the project will be completed in a longer time than planned, which is 211 days.

INTRODUCTION

The development of physical facilities in Indonesia is increasing rapidly along with the government's promotion of modernization with the aim of welcoming the era of globalization. Various large-scale projects are carried out to meet the increasingly complex needs of society. In the implementation of a project it is very rare to find a project that goes exactly as planned. Generally, they experience delays from what was planned, both in terms of time and progress of work, but there are also projects that experience acceleration from the initial schedule planned. Creating a work plan is one of the first steps in planning. Planning is made to achieve high effectiveness and efficiency of the resources to be used during construction project implementation. The planned resources are labor (man),

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equipment (machine), method (method), material (material), and money (money). These resources must be planned as efficiently and effectively as possible in order to obtain minimum implementation costs. In an effort to control project performance against costs and time to make it more effective and efficient, proper and measurable management controls are needed. Control over a particular project activity from the company is known as project management.

The construction of physical facilities also moves and supports the mining and oil sector. In supporting the government's program which has set a lifting target of 1 million barrels of crude oil and 12 BSCFD of natural gas in 2023, it is necessary to make efforts to increase upstream oil and gas operational activities such as drilling development wells or exploration wells. Pertamina Hulu Rokan as a subsidiary of Pertamina in charge of managing upstream oil and gas business activities based on a cooperation contract in the Rokan work area is trying to increase production by targeting 500 new wells by 2022. One of the most basic jobs before RIG undertook drilling is well preparation work. Pad as a place to do drilling. The problems currently faced by implementing companies are cost issues and less time allotted for the process of making one Well Pad and the waiting time for project completion because it involves work from other teams. So that there is an additional cost and working time that must be borne by the implementing company. Therefore it is necessary to do an analysis to calculate the cost and time needed to work on the Well Pad.

The purpose of this study was to determine the time and cost performance of the Well Pad filling and compaction project in the Rokan Riau Oil and Gas Block, and to determine the estimated cost and final project completion time.

The benefits of this research are expected to be able to add insight and knowledge, especially in terms of carrying out construction in terms of cost and time control and it is hoped that it will provide an understanding that systematic cost planning in accordance with a determined schedule will be very beneficial for a project implementation

RESEARCH METHOD

The method used in this research is descriptive quantitative research that describes the conditions of a particular project by analyzing existing data. Data analysis used analytical and descriptive methods. Analytical means that existing data is processed in such a way as to produce conclusive final results. While descriptive means to describe problems that already exist or appear. The Earned Value method examines the trend of schedule variances and cost variances over a period of time during a project. The research focused on controlling the well pad stockpiling and compaction project from the aspect of time and cost using the Earned Value method

RESULTS AND DISCUSSION
Project Overview

The general description of the Well Pad stockpiling and compaction project in the Rokan Riau Oil and Gas Block by PT. Pertamina Hulu Rokan which is used as the object in this final project is as follows:

Project Name: Well Pad Filling and Compaction
Project Location: Rokan Oil and Gas Block Environment, Riau
Name of Service Provider: PT. Pertamina Hulu Rokan
Contract Value: Rp. 5,041,789,130.00
Contract Date: 12 July 2022
Implementation Period: July 19 2022 to November 8 2022
(16 weeks)

Project Performance Identification

In identifying the implementation time, it means analyzing the reporting data on the implementation of activities at a certain time and comparing it with what has been planned, to see the implementation time, a Table 1 can be made.

Table 1
Execution Time Control

week	plan	cumulative	Realization	cumulative
1	0.714	0.714	0.480	0.48
2	0.654	1,368	0.420	0.900
3	0.876	2,244	0.642	1,542
4	0.910	3,154	0.676	2,218
5	0.991	4,145	0.757	2,975
6	1,072	5,217	0.838	3,813
7	2,453	7,670	2,219	6,032
8	3,534	11.204	3,300	9,332
9	5,453	16,657	5,219	14,551
10	7,876	24,533	7,642	22,193
11	10.354	34,887	7,775	29,968
12	15,560	50,447	9,981	39,949
13	17,456	67,903	11,877	51,826
14	16,650	84,553	13,966	65,792
15	12,453	97,006	12,219	78,011
16	2,985	100,000	2,199	80,210

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Source : Data Processing (2022)

NO	Pekerjaan	Harga pekerjaan	durasi	bobot (%)	Minggu ke -																
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	PIPE SUPPORT & PILLING	Rp 379.995.840	12	7,54																	
2	EARTHWORK	Rp 4.176.160.800	27	82,83																	
3	STRUCTURAL STEEL WORKS	Rp 105.884.730	18	2,10																	
4	MISCELLANEOUS WORKS	Rp 282.025.350	16	5,59																	
5	SURVEY WORK	Rp 41.540.700	10	0,82																	
6	LABORATORY TESTING	Rp 947.080	9	0,02																	
7	MISCELLANEOUS WORKS	Rp 3.818.080	12	0,08																	
8	LABORATORY TESTING FOR SOIL PROPERTIES	Rp 51.416.550	12	1,02																	
	Jumlah	Rp 5.041.789.130,00	116	100,00	1 0,48	2 0,42	3 0,642	4 0,676	5 0,757	6 0,838	7 2,219	8 3,3	9 2,19	10 1,42	11 7,75	9,92	11,83	13,96	12,21	2,19	
	Jumlah Akumulatif				0,48	0,90	1,54	2,22	2,98	3,81	6,03	9,33	14,55	22,19	27,75	37,73	51,83	65,79	78,01	80,21	

Figure 2
Realized S Curve

Calculation Analysis Method *Earned Value*

Calculation Analysis *Earned Value* on assignments end this form analysis *Planned Value* (PV), *Earned Value* (EV) and *Actual Cost* (AC).

Calculation of BCWS (*Budget Cost of Work Schedule)*

BCWS = (% progress plan) x (Budget)
Calculation of BCWS in weeks 1st period 19 July 2022 – 26 July 2022:
BCWS = (% plan) x (total project budget)
BCWS = (0.71%) x (Rp. 5,041,789,130.00)
BCWS = Rp. 35,796,703,

Table 2 follows show results calculation *Planned Value* (PV) in week 1 to with 16th week.

Table 2
***Budget Cost of Work Schedule* (BCWS)**

BCWS = (% Weight plan) x (budget)				
Sunday to	Weight plan (%)	Contract Value (Rp)	BCWS (Rp)	Cumulative BCWS
1	0.71	5,041,789,130.00	35,998,374	35,998,374
2	0.65	5,041,789,130.00	32,973,301	68,971,675
3	0.88	5,041,789,130.00	44,166,073	113,137,748
4	0.91	5,041,789,130.00	45,880,281	159,018,029
5	0.99	5,041,789,130.00	49,964,130	208,982,159
6	1.07	5,041,789,130.00	54,047,979	263,030,139
7	2.45	5,041,789,130.00	123,675,087	386,705,226
8	3.53	5,041,789,130.00	178,176,828	564,882,054
9	5.45	5,041,789,130.00	274,928,761	839,810,815

10	7.88	5,041,789,130.00	397,091,312	1,236,902,127
11	10.35	5,041,789,130.00	522,026,847	1,758,928,974
12	15.56	5,041,789,130.00	784,502,389	2,543,431,362
13	17,46	5,041,789,130.00	880,094,711	3,423,526,073
14	16.65	5,041,789,130.00	839,457,890	4,262,983,963
15	12.45	5,041,789,130.00	627,854,000	4,890,837,963
16	2.99	5,041,789,130.00	150,497,406	5,041,335,369

Source: Data Processing (2022)

From Table 2 can seen exists increase Planned Value (PV)/ BCWS value for each week it means plan expenditure cost each week project experience increase.

Calculation of BCWP *(Budget Cost of Work Performance)*

BCWP = (% progress actual) x (Budget)

Calculation of BCWP in weeks 1st period 19 July 2022 – 26 July 2022:
BCWP = (% actual) x (total project budget)
BCWP = (0.39%) x (Rp. 5,041,789,130.00)
BCWP = Rp. 19,662,978.00

Table 3 below show results calculation *Earned Value* (EV) in week 1 to with 16th week.

Table 3
***Budget Cost of Work Performance* (BCWP)**

BCWP = (% Weight realization) x (budget)				
Sunday to	Weight realization (%)	Contract Value (Rp)	BCWP (Rp)	Cumulative BCWP
1	0.39	5,041,789,130.00	19,662,978	19,662,978
2	0.42	5,041,789,130.00	21,175,514	40,838,492
3	0.64	5,041,789,130.00	32,368,286	73,206,778
4	0.68	5,041,789,130.00	34,082,495	107,289,273
5	0.76	5,041,789,130.00	38,166,344	145,455,616
6	0.84	5,041,789,130.00	42,250,193	187,705,809
7	2,22	5,041,789,130.00	111,877,301	299,583,110
8	3.30	5,041,789,130.00	166,379,041	465,962,151
9	5,22	5,041,789,130.00	263,130,975	729,093,126
10	7,64	5,041,789,130.00	385,293,525	1,114,386,651
11	7,78	5,041,789,130.00	391,999,105	1,506,385,756
12	9.98	5,041,789,130.00	503,220,973	2,009,606,729
13	11.88	5,041,789,130.00	598,813,295	2,608,420,024
14	13.97	5,041,789,130.00	704,136,270	3,312,556,294
15	12,22	5,041,789,130.00	616,056,214	3,928,612,508

16	2,20	5,041,789,130.00	110,868,943	4,039,481,451

Source: Data Processing (2022)

From Table 3 can seen exists increase mark *Earned Value* (EV) on each week it means plan expenditure cost each week project experience increase.

Calculation of ACWP (*Actual Cost Work Performance*)

Table 4 shows recapitulation results calculation *Actual Cost* (AC) week 1 arrived with 16th week.

Table 4
Actual Cost Work Performance

Cost Direct and No Live

Sunday to	ACWP (Rp)	Cumulative ACWP (Rp)
1	19,578,000	19,578,000
2	21,084,000	40,662,000
3	32,228,400	72,890,400
4	33,935,200	106,825,600
5	38,001,400	144,827,000
6	42,067,600	167,316,600
7	111,393,800	298,288,400
8	165,660,000	463,948,400
9	261,993,800	725,942,200
10	383,628,400	1,109,570,600
11	390,305,000	1,499,875,600
12	501,046,200	2,000,921,800
13	596,225,400	2,597,147,200
14	701,093,200	3,298,240,400
15	613,393,800	3,911,634,200
16	110,389,800	4,022,024,000

Source: Data Processing (2022)

From Table 4 can seen exists increase mark *Actual Cost* (AC) on each week it means expenditure cost each week project experience increase.

Calculation Analysis Time and Cost Variances Completion Project

  a. Calculation of Schedule Variance (SV)

SV is obtained from BCWP reduction with BCWS:
Calculation of SV by week 1st period 19 July 2022 – 26 July 2022:
SV = (BCWP) - (BCWS)
SV = (Rp. 19,662,978.00) - (Rp. 35,998,374.00)
SV = - Rp. 16,335,397.00
       b. Calculation of Cost Variance (CV)
CV obtained from reduction of BCWP with ACWP:
Calculation of CV by week 1st period 19 July 2022 – 26 July 2022:
CV = (BCWP) - (ACWP)
CV = (Rp. 19,662,978.00) - (Rp. 19,578,000.00)
CV = Rp. 84,978.00
      Table 5 shows recapitulation results calculation *CV and SV* 1st week up with 16th week.

Table 5
CV and SV

Sunday to	SV (Rp)	CV (IDR)
1	- 16,335,397	84,978
2	- 28,133,183	176,492
3	- 39,930,970	316,378
4	- 51,728,756	463,673
5	- 63,526,543	628,616
6	- 75,324,330	20,389,209
7	- 87,122,116	1,294,710
8	- 98,919,903	2,013,751
9	- 110,717,689	3,150,926
10	- 122,515,476	4,816,051
11	- 252,543,218	6,510,156
12	- 533,824,633	8,684,929
13	- 815.106.049	11,272,824
14	- 950,427,669	14,315,894
15	- 962,225,455	16,978,308
16	- 1,001,853,918	17,457,451

Source: Data Processing (2022)

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Criteria for second indicator above good the SV (Schedule Variance) and CV (Cost Variance) with negative SV and Positive CV are summed up that Profession done more fast from the plan with swallow fee above budget.

Calculation Index Productivity and Completion Performance Project

a. Calculation of Schedule Performance Index (SPI)

SPI obtained from BCWP divided by BCWS:

Calculation of SPI in weeks 1st period 19 July 2022 – 26 July 2022:

SPI = BCWP / BCWS

SPI = (Rp. 19,662,978.00) / (Rp. 35,998,374.00) SPI = 0.546

b. Calculation of Cost Performance Index (CPI)

CPI obtained from BCWP divided by ACWP:

Calculation of CPI in weeks 1st period 19 July 2022 – 26 July 2022:

CPI = BCWP / ACWP

CPI = (19,662,978.00) / (19,578,000.00)

CPI = 1.004

Table 6 shows recapitulation results calculation of CPI and SPI 1st week up with 16th week.

Table 6
CPI and SPI

Sunday to	CPIs	SPI
1	1.004	0.546
2	1.217	0.592
3	1.225	0.647
4	1.136	0.675
5	1.185	0.696
6	1.306	0.714
7	1,192	0.775
8	1.196	0.825
9	1,199	0.868
10	1.203	0.901
11	1.106	0.856
12	1.11	0.79
13	1.113	0.762
14	1.117	0.777
15	1,12	0.803

16	1.124	0.801

Source: Data Processing (2022)

SPI value less of 1 shows that time implementation late from planned schedule. CPI value is more big of 1 shows expenditure more small from budget.

Calculation of ETC (*Estimate To Complete*) and EAC (*Estimate At Complete*)

ETC earned from BCWP divided by BCWS:

ETC calculation by week 1st period 19 July 2022 – 26 July 2022:

ETC = (Total Budget – BCWP) / CPI

ETC = (Rp. 5,041,789,130.00 - Rp. 19,662,978.00) / 1.004

ETC = Rp. 5,002,422,000.00

EAC is estimation total cost at the end project.

EAC = ACWP + ETC

EAC calculation by week 1st period 19 July 2022 – 26 July 202: EAC = (Rp. 19,578,000.00) + (Rp. 5,000,422,000.00) EAC = Rp. 5,020,000,000.00

Table 7 shows recapitulation results ETC and EAC calculations 1st week up with 16th week.

Table 7
ETC and EAC

Sunday to	ETC (Rp)	EAC (Rp)
1	5,000,422,000	5,020,000,000
2	4,108,095,299	4,148,757,299
3	4,054,858,627	4,127,749,027
4	4,342,448,424	4,449,274,024
5	4,130,740,206	4,275,567,206
6	3,715,731,600	3,883,048,200
7	3,977,224,763	4,275,513,163
8	3,826,452,705	4,290,401,105
9	3,595,889,685	4,321,831,885
10	3,265,106,717	4,374,677,317
11	3,195,583,537	4,695,459,137
12	2,732,088,529	4,733,010,329
13	2,185,646,874	4,782,794,074
14	1,548,325,738	4,846,566,138

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15	993,605,656	4,905,239,856
16	891,859,397	4,913,883,397

Source: Data Processing (2022)

Calculation of ETS (*Estimate To Schedule*) and EAS (*Estimate At Schedule*)

ETS = Remaining Time / SPI

ETS calculations by week 1st period 19 July 2022 – 26 July 2022: ETS = (120) / (0.546)ETS = 210 days

EAS = Completion Time + ETS

EAS calculation by week 1st period 19 July 2022 – 26 July 2022: EAS = 1 + 210

EAS = 211 days

Table 8 shows recapitulation results ETS and EAS calculations 1st week up with 16th week.

Table 8
Estimated At Schedule

Sunday to	ETS (days)	EAS (days)
1	210.85	211.68
2	193,23	194.82
3	175.25	177.85
4	166.51	170,16
5	159.75	164.56
6	154.07	160,12
7	138.25	147,15
8	124.87	137,87
9	111.36	130.68
10	97,17	125,62
11	88,19	128.66
12	72.75	131,27
13	48,87	127,63
14	23.06	121,14
15	4,32	116.85
16	0.01	116.00

(Source: 2022 Analysis Results)

CONCLUSION

The results of the analysis using the EVM (Earned Value Method) method on the Well Pad Piling and Compaction Project in the Rokan Oil and Gas Block Environment, Riau.

The cost performance of the Well Pad Piling and Compaction Project in the Rokan Oil and Gas Block, Riau Province, does not match the budgeted costs in the 16th week, the costs incurred amounted to Rp. 4,022,024,000.00 with an actual weight percentage of 80.21%. Calculation of the CPI value> 1 from the 1st week to the 16th week. This means that from the 1st week to the 16th week, the project cost is more economical.

The time performance of the Well Pad Piling and Compaction Project in the Rokan Oil and Gas Block Environment, Riau, in the 1st to 16th week, the SPI value < 1. This means that in the 1st to 16th week the project was delayed from the planned schedule. The EAS calculation for the 16th week estimates the project completion time is 116 days or 16 weeks. This means that the project is experiencing a delay from the planned schedule.

At the end of the review period, an estimated final project cost of Rp. 4,022,024,000.00. If the trend of project performance conditions is the same as at the end of the review, namely the 16th week, the estimated value does not exceed the total project cost of Rp. 5,041,789,130.00. And the estimated time for project completion is 116 days, which means the project will be completed in a longer time than planned, which is 211 days

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