

# The Analysis of Time Performance and Charge with Earned Value Method on Expansion and Rehabilitation Kejati Office East Borneo Building Project

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**ABSTRACT:** For the purpose of gain the monitoring efectivity and control the project, it required a method that integrate schedule and charge to show the performance activity and one of the method that conform this purpose is Earned Value Concept, which is consist by three indicator BCWS, BCWP and ACWP. A research done to expansion and rehabilitation kejati office east Borneo building project and completed in 27 weeks and the result is the project save about Rp. 10.268.775.831,04 according to BCWP value. This value is greater than the value of ACWP Rp. 9.010.625.110,21. From the two value mentioned before, noted that *Cost Performance Index* (CPI) = 1,136 > 1 because the actual cost is lower from the plan. However there are some weeks within 27 months that have *Cost Performance Index* (CPI) < 1 that is in 3<sup>rd</sup> week, 8<sup>th</sup> week, 9<sup>th</sup> week and 10<sup>th</sup> week and it indicates the occurrence of waste on that weeks. However the overall project time is decreased, this is seen on condition of the 27<sup>th</sup> week, the *Schedule Performance Index* (SPI) is =0,997 < 1, and the *Schedule Varian* (SV) negative Rp. -29.398.433,07 which is slower from the time plan. It is known that the remaining cost to complete the assignment (ETC) after 27<sup>th</sup> week is Rp. 2.015.836.176,13 or the cost for 100% complete assignment is = Rp. 9.036.522.731,31

**KEYWORDS:** Time Performance, Charge Performance.

## I. INTRODUCTION

In order to espouse the function of government apparatus so the government of East Borneo has done the improvement, enchancement and repairment of facilities and infrastructure owned by the government of East Borneo, even the government allocates grants for some sector including vertical agency in East Borneo which is expansion and rehabilitation kejati office east borneo building project. This activity escalation has been balanced with management escalation which is has been done by Public Works Agency and supervising consultant, but the management that has been done is only shaped in S curve so it should be a review of the concept "*Earned Value*" which is one of the tool that used in project management that integrate charge and time. The purpose of knowing the performance is to monitor the project and control it, so that if there is a deviation, immediate action is taken. Most of the big project only depends on S curve to control the project or the time performance meanwhile the S curve cannot inform the cost performance. This is what drives the reaserchers to do the study of time performance and charge using the Earned Value Method.

To know how performance and completion time of expansion and rehabilitation kejati office East Borneo building project it will be carefully reviewed with Earned Value Method. Based on this matter, it should be review to give completion recommendation support, so in this research can provide advantages for another kind of projects.

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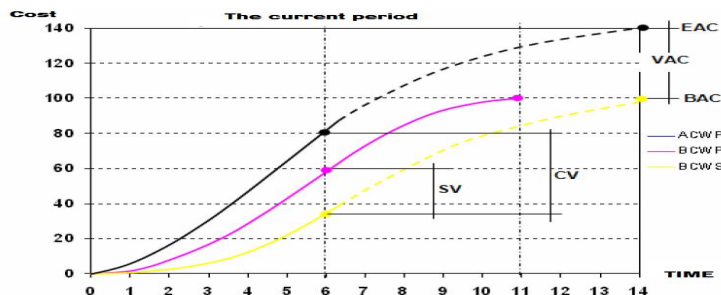
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## II. BASIC THEORY

### A. Earned Value Concept

In the age of 1995 until 1998 *Earned Value Management (EVM)* become a project management standart (ANSI/EIA 748-A) so EVM is not only used by ministry of defense, but also used by industrial circles and the Ministry of Energy in US. The “Earned Value” Concept is an instrument that used in project management that integrates value and time. Earned Value concept shows three dimensions, which is pysical settlement (*the percent complete*) that reflect the cost plan (*Budgeted cost*), the actual costs incurred (*actual cost*) and also what gained from cost that paid (*Earned Value*), can be connected between cost performance with time which comes from variants calculation of cost and time (Flemming and Koppelman, 1994). Earned value method is combining the cost, schedule and the work undertaken with illustrates the monitor value each one or form a management project instrument that can use for evaluate schedule variants and budget at once. Earned Value S curve graphic is shown on the following picture.



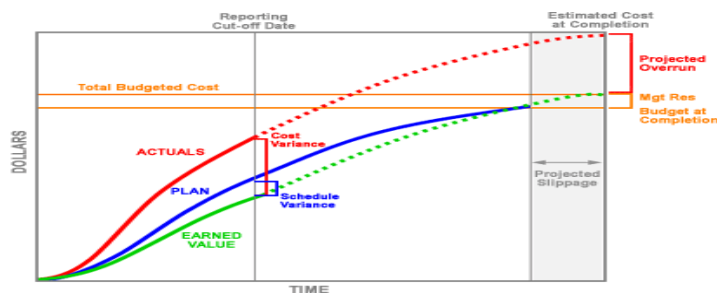
Picture 1 Earned Value S Curve

Source :Biemo W, Soemardi et al, 2006

There are three primary elements that become reference in analyzing the project according to Earned Value concept. The three elements are:

- Budget Cost for Work Scheduled (BCWS)** is the budget that allocated based on work plan which has been complied against time or cost that budgeted from work planned for an activity between the starting date until finishing date of the activity. BCWS calculated from the budget accumulation that planned for certain period of work
- Actual Cost for Work Performed (ACWP)** is the actual cost of work used, wich is the total of actual cost that occur during the work in certain period. As well as representation of whole expenditure to finish the job in a certain period.
- Budgeted Cost for Work Performed (BCWP)** is the budgeted cost from the work achieved or the value received from the completion of the job in a certain period, which is the percentage from the budget that should be spent for work percentage that determined on a work. The BCWP calculated from the accumulation of works that has been done.

The use of *Earned Value* Concept on assessment of project performance could be described by the following picture:



Picture 2 Earned Value S curve

Source :Biemo W, Soemardi et al, 2006

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## B. Analysis Method

The application in analyzing the results from *Earned Value Method*, do some aspects that need to know:

Table 1. Scoring and criteria value

Category	Scoring	Criteria
Perfect	0,90 - 1,00	Works faster and cost less from budget
Very Good	0,70 - 0,89	Works done on schedule and cost less from budget
Good	0,50 - 0,69	Works done on schedule and cost same as budget
Medium	0,30 - 0,49	Works late and cost same as budget
Bad	0,10 - 0,29	Works late and cost more than budget

Source: DeGarmo, 1960

Table 2. Assessment from Earned Value concept indicator

No	Indicator	Value	Status Assignment
1	Cost Variance (CV)	Positive	Saving BCWP > ACWP
		Zero	Planned cost = Actual Cost
		Negative	Wasting BCWP < ACWP
2	Schedule Variance (SV)	Positive	Faster than plan. BCWP > BCWS
		Zero	Plan = Actual
		Negative	Slower than plan, BCWP < BCWS
3	Cost Performance Index (CPI)	>1	Saving BCWP > ACWP
		=1	Planned cost = Actual cost
		<1	Wasting. BCWP < ACWP
4	Schedule Performance Index (SPI)	>1	Fastern than plan. BCWP > BCWS
		=1	Plan = Actual
		<1	Slower than plan, BCWP < BCWS

Source :Biemo et al, 2000

CPI and SPI indicators are more commonly used for project performance assessment than SV and CV. CPI and SPI values are values that do not have dimensions so that it can be done comparison between project performance with other. In addition, the SPI and CPI scores provide a relative comparison to BCWS or Performance Baseline (PMB) which is the basis for assessing project status and terms of cost and time.

Table 3. Integrated Variance Analysis

Schedule Variance SV=BCWP-BCWS	Cost Variance CV=BCWP-ACWP	Information
Positive	Positive	Work is done faster than the schedule at less cost than the budget
Zero	Positive	Work is done faster than the schedule at less cost than the budget
Positive	Zero	Work is done faster than the schedule at less cost than the budget
Zero	Zero	Work is done according to schedule and the budget
Negative	Negative	Work is completed slower than the schedule and cost higher than the budget
Zero	Negative	Work is done according to schedule and take the cost higher than the budget
Negative	Zero	Work is completed slower than the schedule and the cost is according to the budget
Positif	Negatif	Work is done faster than the schedules and cost higher than the budget

Source : Soeharto, 2005

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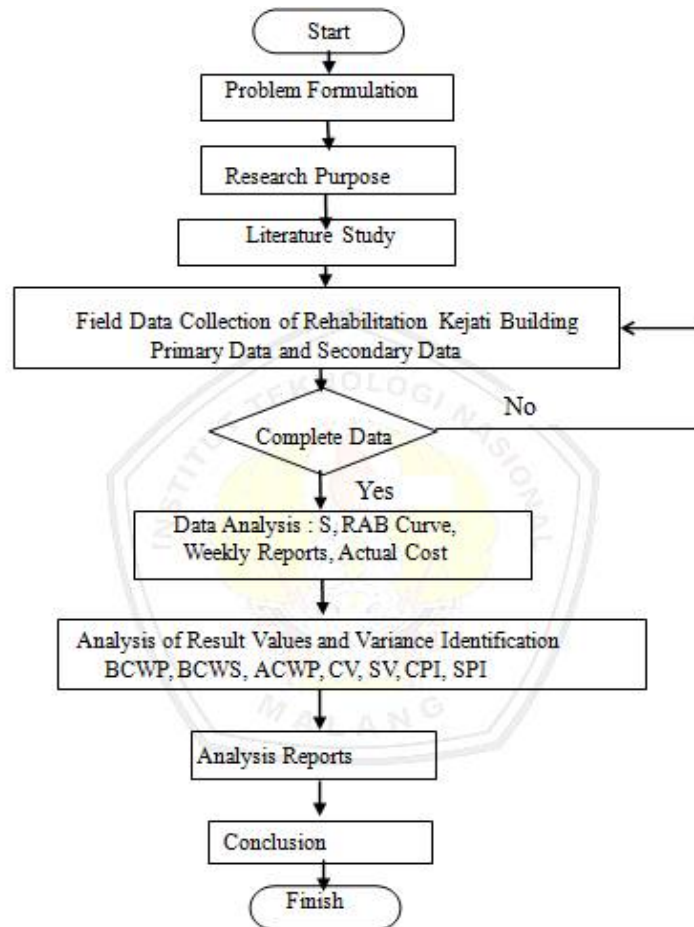
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## III. FLOW OF RESEARCH

Schematic research stages in the form of flow chart as follows:



## IV. DISCUSSION

### A. Project Control Analysis Using Earned Value Method.

In calculating using Earned Value Method, the first step is determine the indicators of Earned Value method, that consist of BCWS, BCWP, ACWP, CPI and SPI.

#### A.1. Calculating the BCWP and BCWS Value

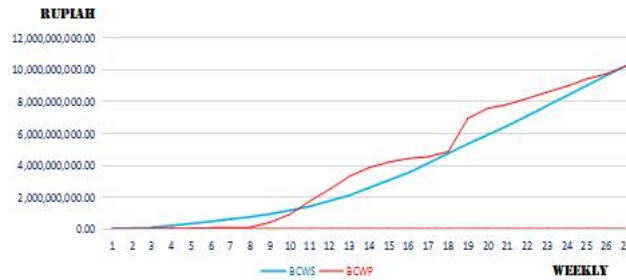
The following shows the relationship between BCWS and BCWP, where BCWP graph is more smooth compared with BCWS.

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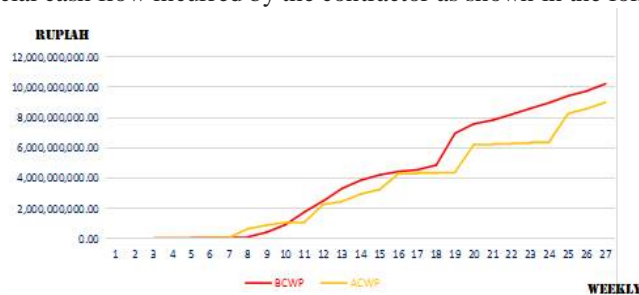
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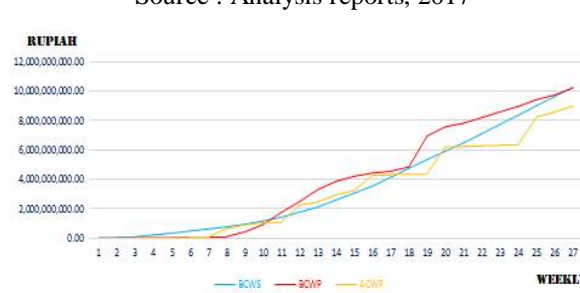
Picture 4 Cumulative BCWS and BCWP Comparison Graph  
Source : Analysis reports, 2017

## A.2.Calculating the ACWP Value

The value of ACWP or Actual Cost is a set of cost incurred by the contractor to complete the work for a certain period. Actual cost is calculated from the accumulated cost incurred for the payment of direct cost and indirect cost. This value is derived from the financial cash flow incurred by the contractor as shown in the following graph.



Picture 5 Cumulative BCWP and ACWP Relation Graph  
Source : Analysis reports, 2017



Picture 6 Cumulative BCWS, BCWP, and ACWP Relation Graph  
Source : Analysis reports, 2017

Based on the analysis of earned value shown in the graph of BCWP, BCWS, and ACWP relation can be seen the difference between the cost of the plan (BCWS) with the realization cost of project implementation (BCWP) as well as the actual cost (ACWP), where the physical progress up to the 11th week, the budget value (BCWS) at the 11th week is 1.425.630.509,20 Rupiah, the progress value (BCWP) is 1,762,414,065.45 Rupiah and the actual cost already incurred (ACWP) is 1.097.497.421.40 Rupiah. From these value can be concluded that up to the 11th week the contractor still has the remaining funds or CV that is 664.916.644,05 Rupiah. Then reviewed at week 27, where the budget value (BCWS) at week 27 is 10.268.775.831.04 Rupiah, the value of BCWP is 10.239.377.397.97 Rupiah and ACWP which is 9.010.652.110,21 Rupiah of these values can be concluded that up to week 27 contractor gets profit or CV that is 1,228,725,287,76 Rupiah, while unfinished work is equal to 7,138% or with value of ETC that is 2.015.836.176,13

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Rupiah. Under such conditions, the project should be evaluated by any factors that lead to delay in implementation time and how to anticipate the problems. Regarding to the problems of delay in project implementation, the business need to be done in this case by improving the system of cost and time performance as well as increasing the labor so that the project delay can be overcome.

## B. Time Performance Analysis and Project Completion Cost

### B.1. Schedule Variance (SV) time performance analysis and Cost Variance (CV) cost performance

The following is given the Table of Results of Time Schedule performance analysis of **Schedule Variance (SV)** and **Cost Variance (CV)** cost performance, so it will be known how long and how much cost is needed to finish the project.

Table 1. Schedule Variance(SV) and Cost Variance (CV) Calculation

Mg	BCWS	BCWP	ACWP	Variant	
	(Rp.)	(Rp.)	(Rp.)	SV	CV
	Cumulative	Cumulative	Cumulative		
1	33.220.000,00	928.124,97	816.749,98	-32.291.875,03	111.375,00
2	74.745.000,00	2.474.999,93	2.177.999,94	-72.270.000,07	296.999,99
3	107.965.000,00	18.974.999,47	25.046.999,31	-88.990.000,53	-6.071.999,83
4	218.627.205,48	31.349.999,13	27.587.999,23	-187.277.206,35	3.761.999,90
5	344.030.146,13	55.274.998,47	29.751.479,17	-288.755.147,66	25.523.519,29
6	485.108.454,36	80.519.997,77	70.857.598,03	-404.588.456,59	9.662.399,73
7	626.186.762,58	80.519.997,77	70.857.598,03	-545.666.764,82	9.662.399,73
8	767.265.070,81	113.519.996,85	659.379.117,00	-653.745.073,96	-545.859.120,15
9	955.369.481,78	431.887.488,02	894.199.813,61	-523.481.993,76	-462.312.325,59
10	1.174.824.627,91	930.979.088,51	1.068.457.422,21	-243.845.539,40	-137.478.333,70
11	1.425.630.509,20	1.762.414.065,45	1.097.497.421,40	336.783.556,25	664.916.644,05
12	1.773.464.625,98	2.496.226.940,08	2.258.191.855,80	722.762.314,10	238.035.084,29
13	2.122.786.75,76	3.314.144.592,72	2.463.020.285,40	1.191.357.834,96	851.124.307,32
14	2.597.511.830,19	3.865.234.712,43	2.947.979.590,74	1.267.722.882,24	917.255.121,69
15	3.072.236.902,61	4.217.340.526,30	3.257.832.706,95	1.145.103.623,68	959.507.819,35
16	3.546.961.975,04	4.435.531.020,22	4.295.116.193,42	888.569.045,18	140.414.826,79
17	4.147.089.988,11	4.547.850.316,51	4.349.710.061,13	400.760.328,40	198.140.255,38
18	4.762.893.368,76	4.858.197.168,52	4.358.448.384,86	95.303.799,75	499.748.783,65
19	5.358.557.336,83	6.964.893.090,10	4.407.965.552,67	1.606.335.753,26	2.556.927.537,43
20	5.922.870.569,74	7.582.205.302,59	6.218.913.710,09	1.659.334.732,85	1.363.291.592,51
21	6.491.383.889,11	7.831.666.113,68	6.246.376.089,01	1.340.282.224,57	1.585.290.024,67
22	7.112.230.336,10	8.206.350.278,14	6.298.586.443,41	1.094.119.942,04	1.907.763.834,73
23	7.755.282.133,72	8.602.245.021,05	6.356.052.261,05	846.962.887,33	2.246.192.759,99
24	8.378.139.720,40	8.978.783.809,68	6.402.186.927,34	600.644.089,28	2.576.596.882,34
25	9.018.830.549,13	9.429.797.219,33	8.258.332.837,29	410.966.670,20	1.171.464.382,04
26	9.651.971.841,76	9.756.690.906,67	8.585.887.997,87	104.719.064,91	1.170.802.908,80
27	10.268.775.831,04	10.239.377.397,97	9.010.652.110,21	-29.398.433,07	1.228.725.287,76

### B.2. Cost Performance Index( CPI ) and Schedule Performance index(SPI)

CPI dan SPI calculation in the next weeks can be seen on table 2

Table 2. CPI & SPI Calculation

Mg	BCWS	BCWP	ACWP	ACHIEVEMENT INDEX (%)	
	(Rp.)	(Rp.)	(Rp.)	SPI	CPI
	Cumulative	Cumulative	Cumulative		
1	33.220.000,00	928.124,97	816.749,98	0,028	1,136
2	74.745.000,00	2.474.999,93	2.177.999,94	0,033	1,136
3	107.965.000,00	18.974.999,47	25.046.999,31	0,176	0,758
4	218.627.205,48	31.349.999,13	27.587.999,23	0,143	1,136
5	344.030.146,13	55.274.998,47	29.751.479,17	0,161	1,858
6	485.108.454,36	80.519.997,77	70.857.598,03	0,166	1,136
7	626.186.762,58	80.519.997,77	70.857.598,03	0,129	1,136

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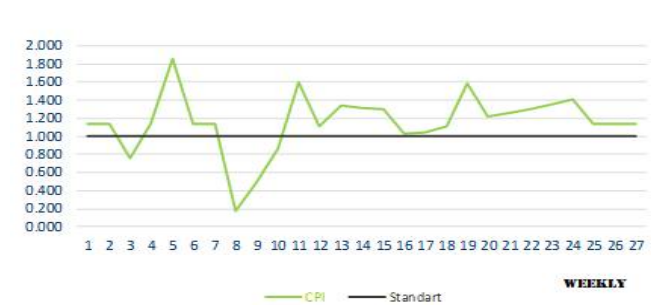
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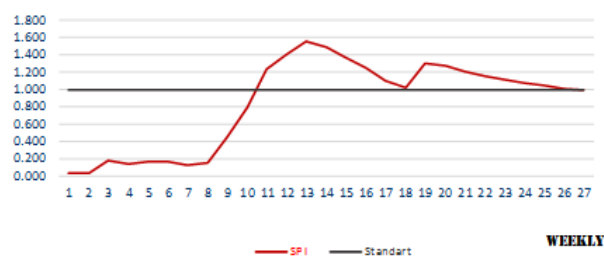
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8	767.265.070,81	113.519.996,85	659.379.117,00	0,148	0,172
9	955.369.481,78	431.887.488,02	894.199.813,61	0,452	0,483
10	1.174.824.627,91	930.979.088,51	1.068.457.422,21	0,792	0,871
11	1.425.630.509,20	1.762.414.065,45	1.097.497.421,40	1,236	1,606
12	1.773.464.625,98	2.496.226.940,08	2.258.191.855,80	1,408	1,105
13	2.122.786.75,76	3.314.144.592,72	2.463.020.285,40	1,561	1,346
14	2.597.511.830,19	3.865.234.712,43	2.947.979.590,74	1,488	1,311
15	3.072.236.902,61	4.217.340.526,30	3.257.832.706,95	1,373	1,295
16	3.546.961.975,04	4.435.531.020,22	4.295.116.193,42	1,251	1,033
17	4.147.089.988,11	4.547.850.316,51	4.349.710.061,13	1,097	1,046
18	4.762.893.368,76	4.858.197.168,52	4.358.448.384,86	1,020	1,115
19	5.358.557.336,83	6.964.893.090,10	4.407.965.552,67	1,300	1,580
20	5.922.870.569,74	7.582.205.302,59	6.218.913.710,09	1,280	1,219
21	6.491.383.889,11	7.831.666.113,68	6.246.376.089,01	1,206	1,254
22	7.112.230.336,10	8.206.350.278,14	6.298.586.443,41	1,154	1,303
23	7.755.282.133,72	8.602.245.021,05	6.356.052.261,05	1,109	1,353
24	8.378.139.720,40	8.978.783.809,68	6.402.186.927,34	1,072	1,402
25	9.018.830.549,13	9.429.797.219,33	8.258.332.837,29	1,046	1,142
26	9.651.971.841,76	9.756.690.906,67	8.585.887.997,87	1,011	1,136
27	10.268.775.831,04	10.239.377.397,97	9.010.652.110,21	0,997	1,136

Source : Analysis reports, 2017



Picture 7 SPI Condition Graph



Picture 8. CPI Condition Graph

From the results of performance index analysis using Earned Value method shown above, it looks that in the implementation of Expansion and Rehabilitation Project of East Kalimantan, Kejati Office, it delayed from week 1st to week 10th (SPI value <1). Then at the 11th week the contractor began to accelerate the implementation of the work like the item of the structure work from the ground floor up to the 4th floor, so that the SPI value changes be greater than 1 (> 1). This situation lasted until the 26th week. then at the 27th week of employment implementation is delayed, this is shown by SPI value <1. Contractor performance shows better achievement with SPI value > 1 at week 11st to week 26th.

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## V. CONCLUSION

Based on the analysis on the Expansion and Building Rehabilitation of East Kalimantan Kejati Office Project using earned value method, can be concluded :

1. The time performance of the Expansion and Building Rehabilitation of East Kalimantan Kejati Office Project is delayed on the 1st week until the 10th week that the performance schedule index (SPI)  $< 1$ . And the 27th week of the schedule performance performance index (SPI) is  $= 0.997 < 1$ , and the value of Variance Schedule (SV) negative  $= -29.398.433.07$  Rupiahie slower than the time of the plan.
2. In general, cost performance in the Expansion and Rehabilitation Project of East Kalimantan Kejati Office Building until 27 weeks experienced savings based on BCWP = Rp. 10.268.775.831.04 value greater than ACWP = Rp. 9.010.652.110,21 and the value of the Cost Performance Index (CPI)  $= 1.136 > 1$  because the actual cost is lower than the plan. But in week 3rd, week 8th, week 9th and week 10th that obtained value of Cost Performance Index (CPI)  $< 1$ , waste occurs on the status assessment

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