INTERNATIONAL JOURNAL ON ADVANCED TECHNOLOGY, ENGINEERING, AND INFORMATION SYSTEM (IJATEIS)

EVALUATION OF COST AND TIME PERFORMANCE OF KARETAN - SAMBIMULYO ROAD MAINTENANCE PROJECT IN BANYUWANGI DISTRICT

Oscar Harris[1*], Risma Marleno[2], Wateno Oetomo[3]
[1-3]Master of Civil Engineering Study Program, Faculty of Engineering,
Universitas 17 Agustus 1945 Surabaya
E-mail: [1)] oscarbasya@gmail.com

Abstract

Along with technological developments in the field of project work implementation, it must also be accompanied by developments in the field of Management as a control function in the implementation of the project. In this case, the application of the Earned Value Concept Method is expected to be able to provide an alternative solution to the problem of evaluating the cost and time that has been spent on project implementation. The purpose of this study is to evaluate a project work that is being carried out, namely in the form of Maintenance of Karetan-Sambimulyo Road, Banyuwangi Regency against Time and Cost Control of the Project, so that it can be used as a reference material by the project implementer and the employer in terms of decision making whether the project is feasible to complete or not. The research was conducted at the end of week 21 (twenty-one), with different evaluation results, thus it can be concluded with the following description: a. Based on Cost Variance (CV) & Schedule Variance (SV) analysis results obtained: Work is carried out later than the schedule plan, costs are lower than the budget plan; b. Based on Cost Performance Index (CPI) & Schedule Performance Index (SPI): Profit but experiencing delays; c. Based on Estimation to Complete (ETC) & Estimation at Completion (EAC): Obtaining a profit of Rp. 263,004,000, 00-,; d. Based on Estimate Temporary Cost (ETC) & Estimate All Cost (EAS): Experienced a Time Delay of 2.09 Weeks.

Keywords: *Earned Value Concept Method, Project Management, Time and Cost Control*

1. INTRODUCTION

Infrastructure development is the driving force of economic development in a region. Infrastructure itself is one of the requirements for other sectors to develop. The development of an area continues to increase along with the increase in population and the need for facilities and infrastructure. Each local government strives to improve the economy of its own region including increasing the acquisition of Regional Original Revenue (PAD) which is a measure of the success of a region in managing its own region. The allocation of local revenue is mostly prioritized for infrastructure development programs. Adequate infrastructure development is needed and is a very important part of the community service system. Infrastructure is the main component of developing economic activities and increasing the efficiency of a country's economic activities (Sadono 2005).

Infrastructure development is necessary in the process of economic growth because it can encourage economic growth, thereby creating new jobs, reducing poverty levels, and increasing per capita income. Infrastructure plays a very important role in the economic growth of a region. Good infrastructure development will ensure efficiency,

facilitate the movement of goods and services, and increase the added value of the economy (Prasetyo and Firdaus 2009).

Infrastructure not only plays an important role in driving economic growth, but also has a broader impact on various aspects of people's lives. Good infrastructure, such as roads, ports, airports and efficient transportation networks, can improve connectivity between regions and facilitate trade, investment and economic growth. Good quality infrastructure affects people's standard of living in areas such as education, health, clean water and sanitation because it gives people better access to basic services needed to improve their quality of life.

Infrastructure development can also create jobs both directly (construction work) and indirectly (maintenance, transportation) which helps reduce unemployment rates and increase people's income. Good transportation infrastructure improves mismarked mobility, reduces traffic congestion, and reduces travel time, which in turn can increase productivity. In addition, transportation infrastructure is a vital object that contributes to driving national economic resilience.

One of the areas of concern to the Indonesian government in implementing transportation infrastructure development is Banyuwangi district. Banyuwangi Regency is one of the districts in the eastern part of East Java Province which is the support of the national economy. In addition, Banyuwangi district is an area rich in natural potential that is so enchanting with various tourist objects of various beaches and hills. This is certainly the basis for the importance of Banyuwangi Regency having adequate infrastructure development.

The Regional Government of Banyuwangi Regency through the Public Works Office of Cipta Karya, Housing and Settlement supports the transportation infrastructure program, especially for the road construction program. The road development program is an activity carried out by the government in the form of programming and budgeting activities, technical planning, construction implementation, and operation and maintenance of roads with the aim of improving transportation infrastructure in an area.

One of the road construction programs that will be discussed in this scientific writing is the Karetan - Sambimulyo Road Maintenance Project, Banyuwangi Regency. The road section is a vital access to the economy and is a connecting road between Bangorejo District and Purwoharjo District.

In the road maintenance project there was a delay in construction implementation due to lack of worker productivity. The project has an implementation period of 26 weeks and the project should have been completed within the specified timeframe.

An evaluation of the project is necessary. Evaluation of road construction projects aims to measure the extent to which a project achieves its objectives effectively and efficiently. It will also assess the extent to which resources (such as time, budget and labor) have been used efficiently in the execution of the project. It also helps identify potential waste or improvements in the use of resources.

Project evaluation is needed to analyze a particular activity as a material for improvement and assessment of the project implementation (PMBOK, 2008). This scientific writing uses a project evaluation method that shows the performance of an activity, namely earned value.

Earned Value (Soeharto 1997) Earned Value is a method that compares the value of physical performance that has been done with the value of work that should have been

done. The Earned Value concept combines cost, scheduling and performance elements to measure project performance. The Earned Value concept is effective because it does not analyze cost and scheduling elements separately.

The author believes that road construction projects, as a temporary activity and must be completed based on a predetermined time, a project requires good management. Good management includes time and resources. Good management performance results from a form of cost, time and quality control that meets predetermined limits.

2. RESEARCH METHODS

The research was conducted on the Karetan - Sambimulyo Road Maintenance work project in Banyuwangi Regency. Based on the data obtained, the work was carried out with a budget value of Rp. budget value of Rp. 2,599,324,000, - (Two Billion Five Hundred Ninety Nine Million Three Hundred Twenty Four Thousand Rupiah) managed by the Public Works Office, Cipta Karya Housing and Settlements of Banyuwangi Regency.

In the implementation of the construction of this project, an analysis will be carried out related to the performance of time and cost costs using the Earned Value method. It is hoped that the analysis data obtained will be able to determine the performance of time and cost so that it can be used to determine the prediction of project completion for the continuation of work that is still unfinished.

The data requirements needed for this research were obtained from previous studies, including WBS, BCWS, ACWP. The next stage is the classification of data that has been obtained and processed into performance result analysis data in the form of BCWP, CPI and CV, SPI and SV. The results of the data processing will be analyzed again to determine the advantages and disadvantages of the method used. This aims to facilitate the development of methods carried out in the future.

3. ANALYSIS AND DISCUSSION

The research location is the Karetan - Sambimulyo Road Maintenance work project, Purwoharjo District, Banyuwangi Regency. The existing condition of the work is a paved and contoured road with an existing width of 4.5 meters which in the plan for the implementation of the road is carried out patchwork work in several spots before resurfacing with hot asphalt material (hotmix). On the shoulder side of the existing road, excavation work will be carried out and replaced with concrete material. Finally, the road will be resurfaced with hot asphalt with the final road width being 6.00 meters. The completion time for this project is scheduled for 26 (twenty six) weeks starting from the end of May 2023 until November 2023.

The project being studied is a project that is being done, so the research is carried out evaluating cost and time only. While the quality is not carried out research because it uses the Earned Value Concept method which only discusses the occurrence of work delays from the plan schedule with the analyzed realization schedule so that the project can be completed as expected. It is intended that in the future the contractor can carry out

work efficiently and effectively with reference to previous work, especially the efficiency of implementation time and implementation costs.

The cost budget plan (RAB) data is obtained from the work budget plan offered to the project owner. Work scheduling data is obtained from the Time Schedule which has been compiled based on work allocation and cost budgeting which is then made into an "S" curve- shaped graph. The project under study experienced deviations in work progress which indicated delays in work completion.

Cost Budget Plan (RAB) data, Time Schedule, Implementation Budget Plan (RAP) are presented in the table below:

Table 1. Budget Recapitulation Table

DAFTAR REKAPITULASI RENCANA ANGGARAN BIAYA (RAB)

KEGIATAN : U35.23. PEMELIHARAAN JALAN KARETAN - SAMBIMULYO
LOKASI : KECAMATAN PURWOHARJO

NO.	URAIAN/JENIS PEKERJAAN	JUMLAH HARGA (Rp)	BOBOT (%)
DIVISI III.	PEKERJAAN TANAH DAN GEOSITETIK	Rp 43,203,330.00	1.84
DIVISI V.	PEKERJAAN BERBUTIR	Rp 59,676,000.00	2.55
DIVISI VI.	PEKERJAAN ASPAL	Rp 1,700,999,110.00	72.64
DIVISI VII.	STRUKTUR	Rp 526,875,000.00	22.50
DIVISI IX.	PEKERJAAN HARIAN DAN LAIN LAIN	Rp 10,980,200.00	0.47
A.	**JUMLAH TOTAL :**	**2,341,733,640.00**	**100.00**
B.	**PPN 11%**	**257,590,700.40**	
C.	**JUMLAH + PPN 11%**	**2,599,324,340.40**	
D.	**DIBULATKAN**	**2,599,324,000.00**	

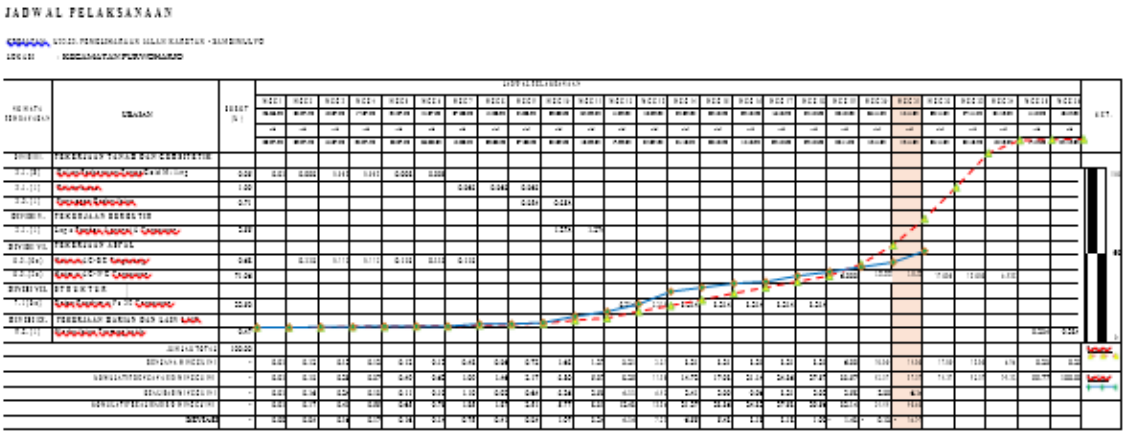
Table 2. Implementation Budget Plan (RAP)

RENCANA ANGGARAN PELAKSANAAN (RAP)

KEGIATAN : U35.23. PEMELIHARAAN JALAN KARETAN - SAMBIMULYO
LOKASI : KECAMATAN PURWOHARJO

NO.	URAIAN/JENIS PEKERJAAN	SAT	VOLUME KONTRAK	HARGA SATUAN (Rp)	JUMLAH HARGA (Rp)	BOBOT (%)
DIVISI III.	**PEKERJAAN TANAH DAN GEOSITETIK**					
3.1.(8)	Galian Perkerasan Tanpa Cold Milling	m3	3.00	238,226.40	714,679.20	0.03
3.1.(1)	Galian biasa	m3	375.00	33,295.50	12,485,812.50	0.59
3.3.(1)	Penyiapan Badan Jalan	m2	1,500.00	9,163.20	13,744,800.00	0.65
				Sub. Total :	**26,945,291.70**	**1.28**
DIVISI V.	**PEKERJAAN BERBUTIR**					
5.1.(1)	Lapis Pondasi Agregat A Terpasang	m3	150.00	286,444.80	42,966,720.00	2.04
				Sub. Total :	**42,966,720.00**	**2.04**
DIVISI VI.	**PEKERJAAN ASPAL**					
6.3.(6a)	Hotmix AC-BC Terpasang	m3	59.00	248,446.00	14,658,314.00	0.70
6.3.(5a)	Hotmix AC-WC Terpasang	m2	9,624.00	159,331.90	1,533,410,205.60	72.85
				Sub. Total :	**1,548,068,519.60**	**73.55**
DIVISI VII.	**STRUKTUR**					
7.1(6a)	Beton Readymix Fc 30 Terpasang	m2	1,500.00	319,637.50	479,456,250.00	22.78
				Sub. Total :	**479,456,250.00**	**22.78**
DIVISI IX.	**PEKERJAAN HARIAN DAN LAIN LAIN**					
9.2.(1)	Marka Jalan Termoplastik	m2	70.00	105,096.20	7,356,734.00	0.35
				Sub. Total :	**7,356,734.00**	**0.35**
A.	**JUMLAH TOTAL :**				**2,104,793,515.30**	**100.00**
B.	**PPN 11%**				**231,527,286.68**	
C.	**JUMLAH + PPN 11%**				**2,336,320,801.98**	
D.	**DIBULATKAN**				**2,336,320,000.00**	

Table 3. Time Schedule



Source: Company Data

The analysis and discussion of this research was carried out on a weekly basis starting on week 21 of the project implementation until the end of the project, where the calculation is highly dependent on the available "S" Curve data. From the reading of the "S" Curve, calculations can be made for each week.

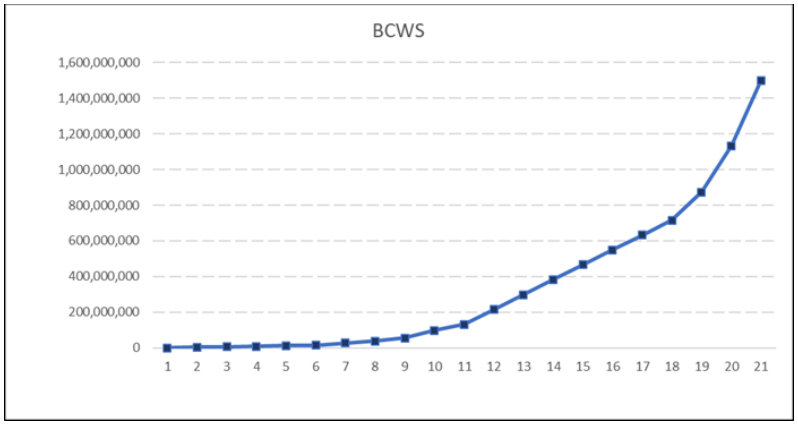


Figure 1. BCWS graph

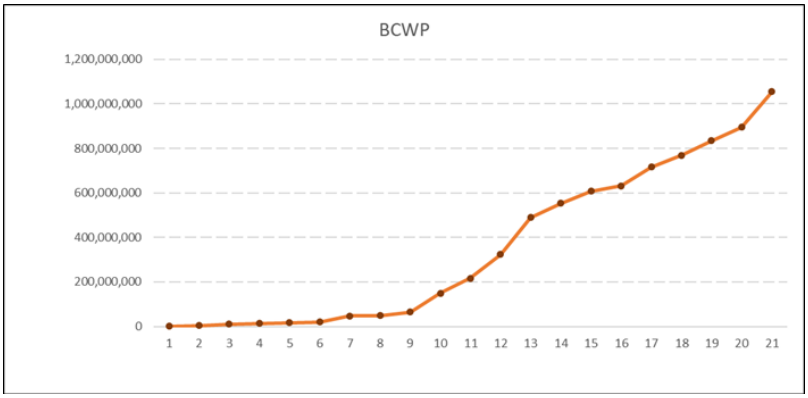


Figure 2. BCWP Chart

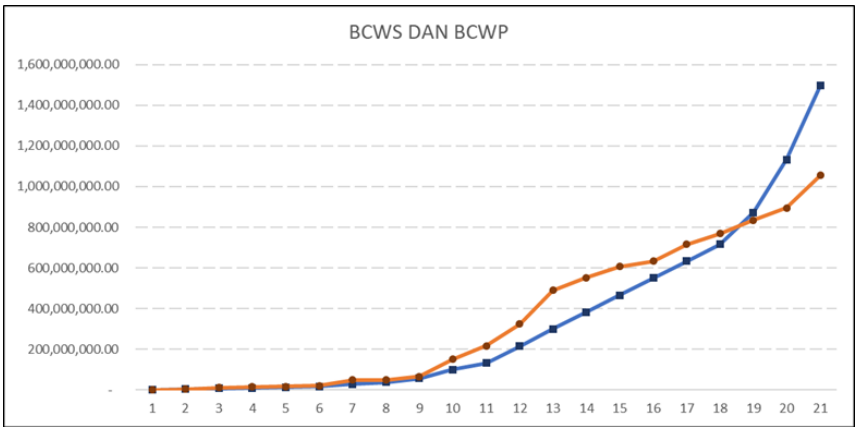


Figure 3. BCWS and BCWP Graph

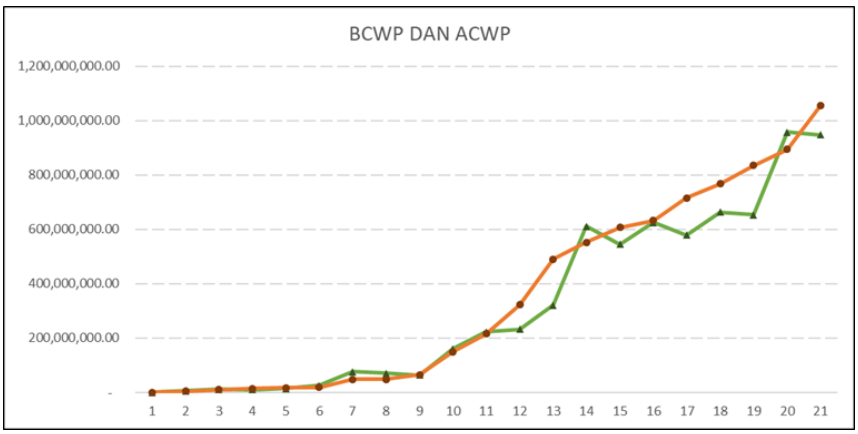


Figure 4. BCWP and ACWP Graph

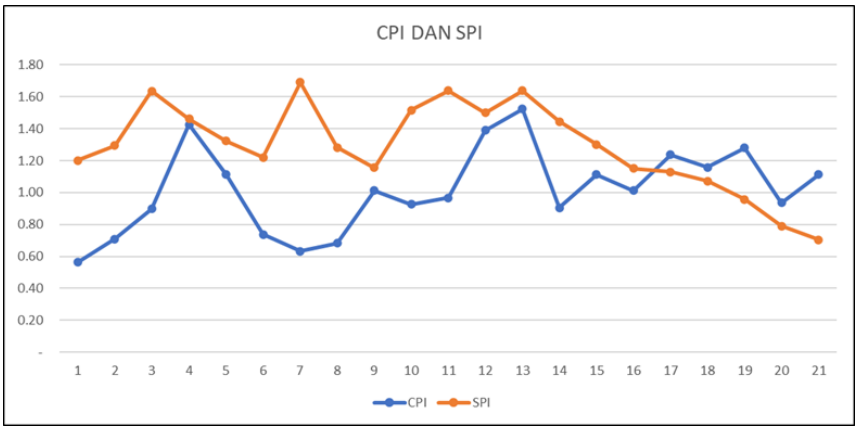


Figure 5. Graph of CPI and SPI

The calculation results for week 21 are as follows:
BCWP = Rp. 1,055,317,500.09,-
BCWS = Rp. 1,496,509,986.94,-
ACWP = Rp. 948,538,689.98,-
CV = BCWP - ACWP
= Rp. 1,055,317,500.09, - Rp. 948,538,689.98, -
= Rp. 106,778,810.10
SV = BCWS - BCWP
= Rp. 1,496,509,986.94,- - Rp. 1,055,317,500.09,-
= Rp. - 441,192,486.85

From the results of positive CV (Cost Variance) and negative SV (Schedule Variance) it can be seen that the indications that occur are: The work is carried out later than the schedule plan, the cost is lower than the budget plan. (behind schedule, under cost).

The value of the Project Cost Performance Index in week 21 can be seen from the calculation results as follows:
CPI = BCWP : ACWP
= Rp. 1,055,317,500.09 : Rp. 1,043,392,558.98
= 1,11 > 1

This means that in week 21 it can be seen that the project is profitable. This can be seen from the CV (Cost Performance Index) value which is positive more than 1, namely getting a profit or Cost Performance Index Value of 1.11> 1.

The implementation schedule aspect can be calculated in the following way:
SPI = BCWP : BCWS
= Rp. 1,055,317,500.09, - : 1.496.509.986.94,-
= 0,71 < 1

It can be seen that the project is experiencing a slowdown in implementation, this is indicated by the SPI (Schedule Performance Index) indicator worth less than 1 or the Schedule Performance Index (SPI) = 0.71 < 1.

If the Project Implementation Performance at week 21 of the study remains the same until the project is completed, the estimated cost required can be calculated as follows:
ETC= Rp. 1,526,559,441.02,-
EAC= Rp. 2,366,320,000.00, -

It can be seen that the EAC value is Rp. 2,366,320,000, meaning that the project will experience a budget gain of Rp. 263,004,000.

As for the schedule aspect, the estimate to complete the project can be calculated in the following way:
ETS= 7.09 weeks
EAS= 28.09 weeks

Which means the project will experience a delay of 2.09 weeks from the planned schedule of 26 weeks.

Table 4. Job indications based on SV and CV

Minggu ke	BCWP	BCWS	ACWP	SV	CV	Indikasi
				BCWP - BCWS	BCWP - ACWP	
20	895,199,141.69	1,132,604,626.94	957,499,439.80	-237,405,485.25	- 62,300,298.11	Pekerjaan terlaksana lebih lambat dari pada jadwal rencana, biaya lebih tinggi dari pada rencana anggaran. (behind schedule, over cost)
21	1,055,317,500.09	1,496,509,986.94	948,538,689.98	-441,192,486.85	106,778,810.10	Pekerjaan terlaksana lebih lambat dari pada jadwal rencana, biaya lebih rendah dari pada rencana anggaran. (behind schedule, under cost)

Based on the data provided, there is information related to the project or work in progress represented through a number of parameters. Week 20 shows that the BCWP value of 895,199,141.69 is lower than the BCWS of 1,132,604,626.94, while ACWP reaches 957,499,439.80. Furthermore, the comparison between BCWP-BCWS and BCWP-ACWP indicates a mismatch between the work that has been carried out and the planned schedule and budget. Week 21 shows that the work was executed later than the plan schedule, with BCWP reaching 1,055,317,500.09, while ACWP was 1,496,509,986.94. The difference between BCWP and BCWS of 106,778,810.10 indicates that the project is delayed from the planned schedule. However, the actual cost was lower than the budget, which can be interpreted as a budget overrun. In this context, the project can be characterized as "behind schedule, under cost."

Table 5. Indication of work based on CPI and SPI

Minggu ke	CPI	Indikasi	SPI	Indikasi
	BCWP / ACWP		BCWP / BCWS	
20	0.93	Mengalami kerugian	0.79	Mengalami keterlambatan
21	1.11	Memperoleh keuntungan	0.71	Mengalami keterlambatan

Based on the data provided, there is project-related information measured using several project management metrics, such as CPI (Cost Performance Index) and SPI (Schedule Performance Index). Week 20 showed a CPI value of 0.93, indicating that the project was losing money because the actual cost (ACWP) was higher than the value of

the work completed (BCWP). In addition, the SPI in that week was 0.79, indicating that the project experienced delays in achieving the predetermined schedule.

While in week 21, a positive change was seen with a CPI value of 1.11, indicating the project made a profit because the actual cost (ACWP) was lower than the value of the work completed (BCWP). However, the SPI in that week was 0.71, indicating that the project was still experiencing delays.

Overall, the changes in CPI and SPI values give an idea of the project's performance. An increase in the CPI value at week 21 indicates an improvement in cost management, but the lingering delays, as reflected by the SPI, are noteworthy. Evaluation of these indications can help the project team to identify areas for improvement to achieve better cost efficiency and schedule compliance in project implementation.

Table 6. Job indications based on ETC and EAC

Minggu ke	ETC	EAC ACWP + ETC	Indikasi	
20	1,822,721,360.20	2,780,220,800.00	Kerugian sebesar	-180,896,800.00
21	1,387,781,310.02	2,336,320,000.00	Keuntungan sebesar	263,004,000.00

In a project or financial context, the data provided illustrates the progression from week 20 to week 21. In week 20, the estimated cost to complete the project (ETC) stood at 1,822,721,360.20, while the actual cost plus ETC (ACWP + ETC) stood at 2,780,220,800.00. The difference between the actual and estimated cost to complete the project (ACWP + ETC) showed a loss of 180,896,800.00. However, at week 21, a positive change occurred. ETC decreased to 1,387,781,310.02, and ACWP + ETC reached 2,336,320,000.00. In this case, the difference between the actual and estimated costs to complete the project resulted in a profit of 263,004,000.00. Overall, the change from week 20 to week 21 shows an improvement in project performance, with the project achieving a profit compared to the loss in the previous week.

Table 7. Job indications based on ETS and EAS

Minggu ke	ETS Sisa Waktu/SPI	EAS Waktu Selesai + ETS	Indikasi		
20	7.59	27.59	Keterlambatan selama	-1.59	Minggu
21	7.09	28.09	Keterlambatan selama	-2.09	Minggu

In Week 20, the activity was scheduled to finish at 7.59, but finished at 27.59, showing a delay of -1.59. Likewise, in Week 21, the activity was scheduled to be

completed at 7.09, but was completed at 28.09, indicating a delay of -2.09. In the context of time or project management, understanding these delays is important to evaluate and improve the scheduled activities.

4. CONCLUSION

From the results of the above analysis, it can be concluded that the condition of the project implementation with the EV (Earned Value) method can be known:

1. Cost performance is efficient with a CPI index of 1.11 > 1 and time performance shows a SPI index lag of 0.71 < 1.
2. The estimated total budget cost until the project is completed is Rp. 2,336,320,000, - from the budget plan of Rp. 2,599,324,000, - and the estimated time until the project is completed is 28.09 weeks, from the plan of 26 weeks, meaning that the project is delayed for 2.09 weeks.

5. ADVICE

Control should be carried out from the beginning of the project, which if this is done, will result in the work being faster than the planned time (Schedule) and the implementer will benefit from the budget plan (RAB) that has been set.

Supervision in a project work should be carried out since the start of project implementation, this is very necessary to avoid unwanted things that can occur in the implementation of the project.

REFERENCES

Prasetyo, Rindang Bangun, and Muhammad Firdaus. 2009. "Pengaruh Infrastruktur Pada Pertumbuhan Ekonomi Wilayah Di Indonesia." *Jurnal Ekonomi Dan Kebijakan Pembangunan* 2 (2): 222–36.

Sadono, Sukirno. 2005. "Makroekonomi Teori Pengantar Edisi Ketiga." *PT Raja Grafibdo Persada: Jakarta*.

Soeharto, Iman. 1997. "Manajemen Proyek." *Jakarta: Erlangga*.

Copyrights