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ANALYSIS OF TIME AND COST CONTROL OF SEDIMENT TRAP CHECKDAM CONSTRUCTION IN BANDUNG AND SUMEDANG REGENCY

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ABSTRACT:
The main objective of construction management is to manage or regulate the implementation of construction projects, so that results are obtained in accordance with what was planned, both the time of implementation, the cost of implementation and the quality produced. In order to achieve the main objectives of construction management, one of the important factors that must be considered is labor productivity. In a construction project the factors that affect labor productivity include wages, time, equipment, formal education, work experience, location of materials, number of helpers (laden) and so on. Controlling the time and cost of this construction was carried out on the CHECKDAM construction project in the Cikeruh area, Jatinangor sub-district, Sumedang, West Java, Indonesia. Previously, Cikeruh Village was included in the Jatinangor District area, which was originally named the Cikeruh sub-district. However, over time, in 2000, the Cikeruh sub-district officially changed its name to the Jatinangor sub-district, West Java, with the aim of knowing the performance of the project. This control is carried out based on completed projects in terms of time and cost control using the concept of Earned Value Analysis which consists of three indicators, namely BCWS, BCWP, and ACWP. This control is carried out on time deviations (SV), deviations from costs (CV), deviations from the total budget (BV). The analysis was carried out in units of weeks (12 weeks). Based on Earned Value analysis, the deviation from the schedule (SV) in the Check Dam Development in Bandung and Sumedang Regencies is 0.

Keywords: Sediment Trap Checkdam Construction, Time Control, Cost Control.

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INTRODUCTION

Sediment is the main material forming the morphology (topography and bathymetry) of the coast. Sediment comes from the fragmentation (breaking down) of rock. The split occurs due to weathering(weathering) which can take place physically, chemically, or biologically. Changes in coastal/estuary morphology occur as a result of the movement of sediments that take place through erosion, transport and deposition mechanisms. The displaced sediment is sediment that lies on the surface of the bottom of the waters (Poerbondone and Djunasjah, 2005).

Sedimentation in the coastal environment originates from the presence of sediments originating from the mainland and is basically the main factor in forming the beach. Sedimentation is closely related to the geomorphic agents working in it. The main geomorphic agents that cause or influence the processes and dynamics of coastal waters are waves, currents and wind. Sediment trap, a sediment catchment pond located at pit to capture and precipitate sediment before it enters the sump so that when it is carried out running pumping, the sediment material to be transported will be slightly reduced. Sediment material that enters together with runoff water is calculated based on rainfall data maximum and minimum in 2018 and 2019.

Stokes' law is used to calculate the depositional velocity at sediment trap1 and sediment trap2 based on the diameter of the Go worth grain size scale. Other factors that are calculated are settling time, flow velocity, residence time and percentage of deposition for 4 sediment classes namely gravel, sand, silt and clay. Simple linear regression is used in the deposition time equation with the diameter of the class of sediment particles that enter it sediment trap. Cikeruh River is one of the rivers in Sumedang, West Java. The dynamics of land management in the Cikeruh Watershed (DAS) is a watershed that flows over two regencies, namely Bandung and Sumedang regencies.

Which has very important roles and functions, including supporting economic development and ecological (environmental) functions. The area which is located in the Cikeruh Sub-Watershed consists of settlements, irrigated rice fields, rain-fed rice fields, fields, shrubs, gardens and plantations. However, changes in land use change that occurred in the Cikeruh Watershed from agricultural land to non-agricultural land encouraged the community to pursue their agricultural activities in the upstream area, of course this resulted in a very high level of erosion and sedimentation hazard.

Erosion is any natural release and transfer of rock masses from one place to another by a carrier substance that moves over the earth's surface. While sedimentation is the process of transporting/carrying sediment by a runoff/flow of water that is deposited in a place where the speed of the water slows down or stops, such as in river channels,

reservoirs, lakes and areas along the edges of bays/seas (Arsyad, 1989). Erosion can affect land productivity which usually dominates the upstream watershed and can provide impact negative in the downstream watershed (around the river mouth) in the form of sediment products.

Based on the results of research in 2002 by the PPSDAL Research Team at the Unpad Bandung Research Institute, it is known that the calculation of the total erosion hazard using land use or cover maps in the upstream Citarum River Basin is 15,206,301 tons/Ha/year, and one of the Sub Watershed Areas which gave the highest contribution was the Cikeruh Watershed of 2,156,128 tons/ha/year (Mind of the People March 9, 2010).

This is due to the use of land that is not in accordance with the potential of the land which does not consider the level of surface erosion, and this is also caused by agricultural activities with very high intensity which are carried out on land with quite steep slopes and conditions without protective vegetation cover against erosion. Erosion is one of the causes of sedimentation, especially in the downstream areas and causes flooding during the rainy season. As for most of the erosion hazard in the study area, in the Cikeruh River Basin, which is as high as 34.66% or an area of 4112.35 Ha.

The level of erosion hazard in the study area is very severe with a total area of 5803 Ha or around 48.91%.The potential for sedimentation in the study area, in the Cikeruh Sub-Watershed, which will occur if the total erosion hazard per year is 2,008,571.06 tonnes/year is 255,088.53 tonnes/yr. As for the thickness of the potential volume sedimentation that is 212657.1m^3 and the overall thickness potential is 0.936 m/year, where the result is obtained from the potential volume of sedimentation divided by the area that has the potential to be used as a sedimentation area, if the assumption of suspended load thickness is 0.624 m/year and bed load is 0.312 m/year.

Erosion and sedimentation are problems in the sub-water she driver Cikeruh, a very high level of erosion and sedimentation hazard can be controlled or suppressed, one of which is with the participation of the community, for this reason efforts are needed to control it. Efforts to control erosion and sedimentation cannot be carried out alone by the government but need the participation of the community. Does the community participate.

According to Conyers in Supriatna (2000) there are three main reasons why community participation is very important, firstly community participation is a tool to obtain information about the conditions, needs and attitudes of the local community, without the presence of development programs and projects will fail. Second, that public will trust a development program more if they feel involved in its preparation and planning process. Third, it is a democratic thing when the community is involved in every development program. This reason seems clearly implied in the

erosion and sedimentation control program, this program is very conducive to the growth of community participation in its implementation. The form of support or community participation in erosion and sedimentation control that is more easily recognized is the form of participation given in the existing implementation.

Therefore it is necessary to conduct research to know for sure. In addition, research can also answer socio-economic conditions, forms of socialization from government and community participation. Then this research will also produce recommendations that can be used as input to related agencies and to the community in the Cikeruh Sub-Watershed. With the condition of the relatively steep Cikeruh river bed, the high flow velocity will be easily eroded, especially at the bottom, the river walls. When the rainy season arrives, the possibility of erosion can be greater.

The dynamics of land management in the watershed system will affect the condition of the river flow, which causes changes in river flow discharge as a watershed output, resulting in changes in environmental quality. The impact that is often seen is land damage due to increased soil erosion and sedimentation. Erosion caused by damage to the vegetation cover causes a hazard for landslides which are a source of sediment deposits if they enter the watercourse. With the river conditions as mentioned above, the Cikeruh River has great potential for flooding, landslides on the river bed and walls, and so on due to the relatively steep slope of the river bed. With reference to this background, it is necessary to deal with the amount of sediment entering the river. So to control the sediment it is necessary to have land conservation measures.

However, the implementation of this conservation measure has time constraints, where the results are not very significant in the near future. For this reason, it is necessary to construct a Sediment Control Building as a support for safeguarding the Cikeruh Watershed from erosion and sedimentation hazards. The purpose of sediment control for the Cikeruh River is to produce a design for a Sediment Control Building (Check Dam) with the aim of analyzing flood discharge, calculating Check Dam dimensions to reduce sedimentation in the downstream river which causes water to overflow, and determining Check Dam stability.

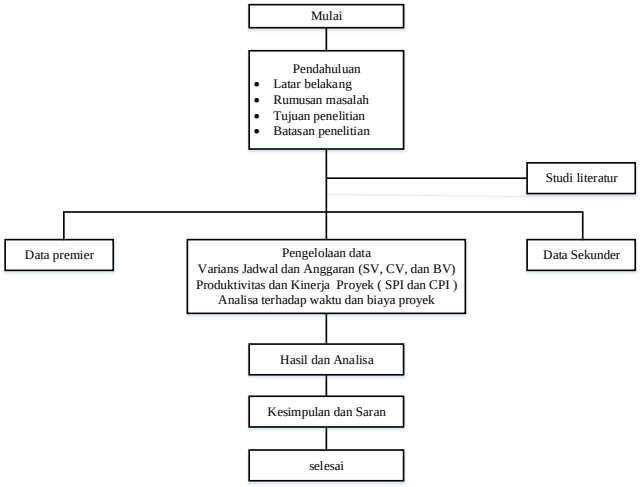
The construction of the Check Dam on the Cikeruh river is planned to be located at Cikeruh, Jatinangor, Sumedang Regency, West Java 45363.Construction work project sendiment trap Check DAM Sumedang Regency which was carried out by this contractor. The project cost budget is something that causes problems that are often encountered in the implementation of a construction project. Project cost control is important to maintain project performance so that it can be on time, quality and cost. Earned Value Concept is a method for analyzing the project cost performance index to determine the estimated final project budget based on project data in the form of BCWP, BCWS,

and ACWP obtained from project accounting data. Project cost control analysis is carried out using the indicators Cost Variance (CV), Cost Performance Index (CPI), Estimate To Complete (ETC), and Estimate At Completion (EAC).

For manage and supervise this activity so that it can run smoothly, on time, right quality and cost, as well as orderly administration in accordance with applicable regulations/related to work. In this regard, the author is interested in compiling a final project entitled "Time and Cost Control for the Construction of Sedimen Trap Check Dam in Bandung and Sumedang Regencies". The objectives of this research were: (1) To find out the time deviation in Construction Work Projects Sediment Trap Check DAM Cikeruh area, Sumedang, West Java. (2) Knowing deviations from costs in Construction Work Projects Sediment Trap Check DAM Cikeruh area, Sumedang, West Java. (3) Find out the deviations from the expenditure budget in Construction Work Projects Sediment Trap Check DAM Cikeruh area, Sumedang, West Java. (4) Knowing the cost and time performance index on Construction Work Projects Sediment Trap Check DAM Cikeruh area, Sumedang, West Java.

RESEARCH METHODS

Figure 1
Research Method Flowchart



Data Umum Proyek
Project General Data

The general data for this project are:

1	Project name	Sediment Trap Construction Work for Cekdam Cikeruh
2	Project costs	IDR 10,645,559,000.00 (Ten Billion Six Hundred Forty Five Million Five Hundred Fifty Nine Thousand Rupiah)
3	Project location	Cikeruh, Jatinangor, Sumedang Regency, West Java
4	Project owner	PPK River and Beach III SNVT BBWS Citarum
5	Executing Contractor	PT. Main Supreme Lord
6	Start date	01 May 2020
7	Date of completion	31 July 2021

Labor Relations Organizational Structure

Work Relations Coordination Structure between Service Users, Construction Management Consultants and contractors, Organizational structure for

carrying out construction management consulting work activities Rehabilitation and renovation of school infrastructure in Ogan Ilir and Ogan Komring Ilir districts, from the organizational structure of the activity implementing team and the organizational structure in relation with service users.

Based on Figure 1, the basic framework of thought that has been compiled according to the previous literature study, the hypothesis can be concluded. Analysis of Time and Cost Control of Trap Check Dam Sediment Construction in Bandung and Sumedang Regencies requires a construction implementation methodology to guarantee project performance with effective project duration and cost. Data processing begins with collecting and studying literature related to management. Collect field data to be used as data in objects. The method used in this writing is as follows:

1. Literature study by collecting references and methods needed as a literature review both from books and other media (internet)
2. Processing and analysis of the data obtained.
3. Drawing conclusions and suggestions from the results of the study.

Types of Sources and Data Primary data for this study were obtained from direct observation by conducting field surveys on research objects in Construction Work Projects. Sediment Trap Check Dam in Bandung and Sumedang Regencies. Secondary data for this study were obtained from contractors implementing the Sediment Trap Cekam Construction Project in Bandung and Sumedang Regencies, West Java. namely PT. Mulya Agung Utama The data includes: (a) Cost Budget Plan (RAB), (b) Time Schedule, (c) Weekly Progress Report, (d) Information about the System and Existence of the Project. Data analysis method is done in a way*Budget At Completition* and the Earned Value Method

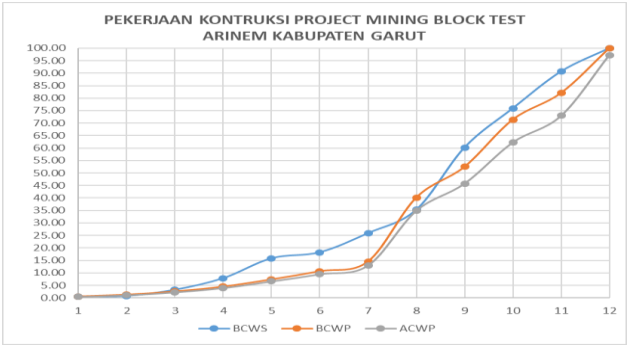
Table 1
Budget Plan (RAB)

No	Type of work	Total Price (Rp)
1	earthworks	3,932,042,721
2	revetment pond sediment trap	1,627,450,626
3	inspection road work	2,010,819,760
4	inlet revetment	1,015,950,811
5	inlet building	795,547,878
6	outlets building	406,578,707
7	revetment di outlet	95,254,471
8	sewer	254,697,450
9	road bridge work	411,966,331
10	other jobs	104,291,184
	Amount	10,645,599,940
	PPN 10%	1,064,559,994
	Total number	11,710,159,934

Source: PT. His Excellency the Great Chief

The relationship between BCWS, BCWP and ACWP can be seen in Figure 1.

Figure 1
Graph of "Earned Value" S Curve Source: PT. His Excellency the Great Chief



RESULTS AND DISCUSSION

Data Analysis

Analysis of controlling the time and cost of constructing a checkdam settlement trap in Bandung and Sumedang districts uses the Result Value Analysis method based on projects that have been completed for 12 weeks. Value analysis has three basic elements, namely BCWS, BCWP, and ACWP analysis.

1. **Yield Value Analysis**

   a. Deviation Against Time (SV)

   To get the SV value for each period, the formula is used:

   SV = BCWP – BCWS ……(4.1)

   With:

SV = Deviation against time

BCWP = Cost based on completion of work within the time period

BCWS = Cost based on planning in a period of time

With equation 4.1, SV can be calculated as follows:

a. SV value in the first week. The value is known:

BCWP = IDR 20,960,187.66
BCWS = IDR 20,557,107.13
SV = IDR 20,960,187.66 - IDR 20,557,107.13 = IDR 403,080.53

(The resulting value of reducing BCWP with BCWS shows a positive value, this can mean that the implementation is faster than the planned schedule)

b. SV value in the second week. It is known the value of:

BCWP = IDR 29,424,878.83
BCWS = IDR 8,101,918.69
SV = IDR 29,424,878.83- IDR 8,101,918.69 = IDR 21,322,960.14

(The resulting value of reducing BCWP with BCWS shows a positive value, this can mean that the implementation is faster than the planned schedule)

c. SV value in the eighth week. The value is known:

BCWP = IDR 1,031,886,161.81
BCWS = IDR 378,694,159.77
SV = IDR 1,031,886,161.81 – IDR 378,694,159.77 = IDR 653,192,002.04

(The resulting value of reducing BCWP with BCWS shows a positive value, this can mean that the implementation is faster than the planned schedule). For the calculation of schedule deviations (SV) per week according to point 1, point 2 and point 3, it can be seen in table 3 and the schedule deviation graphs in Figure 1 and Figure 2.

Table 2
Analysis Schedule Varians (SV)

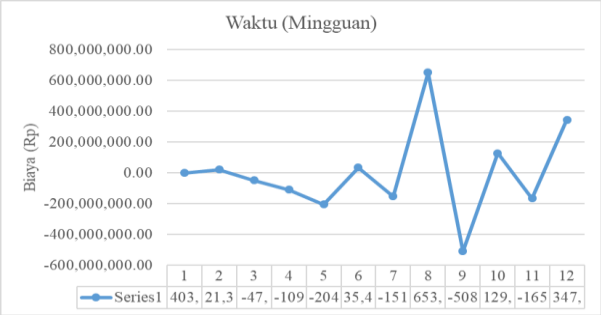
No	Period	BCWP (IDR)	BCWS (IDR)	SV Weekly (IDR)	SV Cumulative (IDR)
1	Week 1	20,960,187.66	20,557,107.13	403,080.53	403,080.53
2	Week 2	29,424,878.83	8,101,918.69	21,322,960.14	21,726,040.67
3	Week 3	51,997,388.62	99,923,663.87	-47,926,275.25	-26,200,234.58
4	Week 4	77,794,542.67	187,029,366.83	-109,234,824.16	-135,435,058.74
5	Week 5	116,288,733.47	320,650,563.17	-204,361,829.70	-339,796,888.44
6	Week 6	132,815,035.28	97,343,948.47	35,471,086.81	-304,325,801.63
7	Week 7	157,604,488.00	309,203,076.06	-151,598,588.07	-455,924,389.70
8	Week 8	1,031,886,161.81	378,694,159.77	653,192,002.04	197,267,612.34

9	Week 9	496,998,295.90	1,005,968,083.61	-508,969,787.70	-311,702,175.36
10	Week 10	761,822,205.40	631,909,349.95	129,912,855.45	-181,789,319.91
11	Week 11	429,683,847.07	594,946,865.17	-165,263,018.10	-347,052,338.01
12	Week 12	723,529,554.86	376,477,216.85	347,052,338.01	0.00

Source: Analysis Results

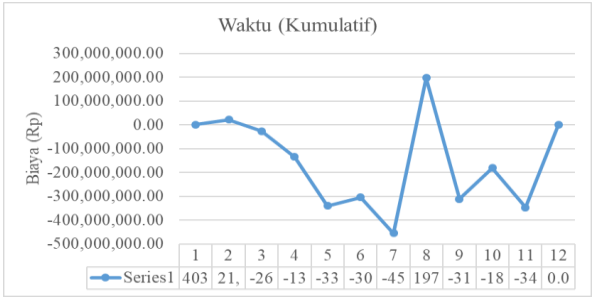
The results of the SV analysis are a representation of the ongoing progress of a project. Basically the SV value represents the actual progress of the work where the value is obtained from the reduction of the actual value (BCWP) with the planning value (BCWS). Implementation is faster than planning if the SV value is positive, if the SV value is negative then implementation can be declared late.

Figure 2
Weekly Analysis Schedule Variance (SV) chart



Source: Results of Analysis Based on Equations.

Figure 3
Graph Analysis Schedule Variance (SV) Cumulative' Deviation Against Cost (CV)



Source: Cumulative SV analysis results based on equation 4.1

To display the CV value for each period, the formula is used:

CV = BCWP – ACWP .....(4.2)

With:

CV = Deviation from Fees
BCWP = Cost based on completion of work within the time period
ACWP = Expenses incurred based on time

d. For work in the first week of
BCWP = IDR 20,960,187.66
ACWP = IDR 17,588,968.67
CV = IDR 20,960,187.66 - IDR 17,588,968.67 = IDR 3,371,219.00
(This value indicates that the work that has been carried out is completed by swallowing the budget below the implementation budget outside of taxes. Because taxes are input at the end of the project)

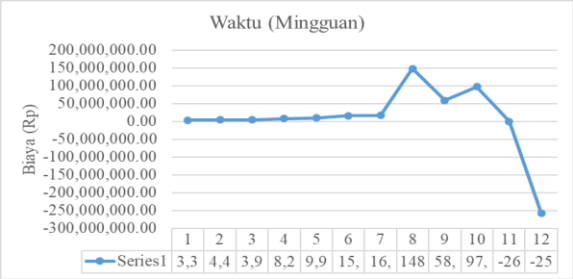
e. For work in the second week
BCWP = IDR 29,424,878.83
ACWP = IDR 24,976,335.50
CV = IDR 29,424,878.83 - IDR 24,976,335.50 = IDR 4,448,543.33
(This value indicates that the work carried out was completed by swallowing the budget below the implementation budget excluding taxes. Because taxes are input at the end of the project). To calculate weekly schedule deviations (CV) in the same way as above, it can be seen in table 4 and the schedule deviation graphs in Figures 2 & 3.

Table 4
Analysis Schedule Varians (CV)

No	PERIOD	BCWP	ACWP	CV	
		(IDR)	(IDR)	Weekly (IDR)	Cumulative (IDR)
1	Week 1	20,960,187.66	17,588,968.67	3,371,219.00	3,371,219.00
2	Week 2	29,424,878.83	24,976,335.50	4,448,543.33	7,819,762.33
3	Week 3	51,997,388.62	48,053,062.39	3,944,326.23	11,764,088.55
4	Week 4	77,794,542.67	69,546,782.10	8,247,760.57	20,011,849.12
5	Week 5	116,288,733.47	106,307,726.61	9,981,006.86	29,992,855.98
6	Week 6	132,815,035.28	116,861,107.81	15,953,927.47	45,946,783.45
7	Week 7	157,604,488.00	140,746,927.26	16,857,560.74	62,804,344.19
8	Week 8	1,031,886,161.81	883,740,141.60	148,146,020.21	210,950,364.39
9	Week 9	496,998,295.90	438,141,209.45	58,857,086.46	269,807,450.85
10	Week 10	761,822,205.40	664,546,414.10	97,275,791.30	367,083,242.15
11	Week 11	429,683,847.07	429,944,750.05	-260,902.98	366,822,339.17
12	Week 12	723,529,554.86	980,420,839.42	-256,891,284.55	109,931,054.61

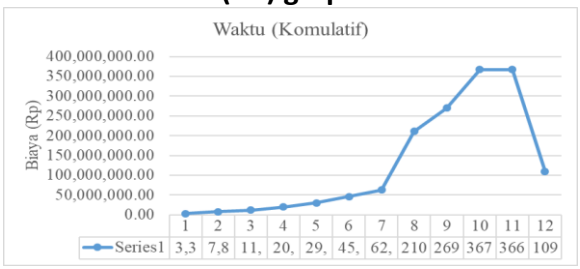
The difference of Rp. 3,371,219.00 in the first week was due to the fact that the money that came out during implementation was lower than the planned weight. This is because the tax expenditure paid at the end of the project affects the deviation in the CV analysis

Figure 4
Weekly Analysis Schedule Variance (CV) chart



Source: Results of Analysis Based on Equation 2.

Figure 5
Cumulative Analysis Schedule Variance (CV) graph



Source: Cumulative CV Analysis Results Based on Equation 2.

b. Deviation Against Budget (BV)

To display the BV value for each period, the formula is used:

BV = BCWS – ACWP .....(4.3)

With:

BV = Deviations against the budget

BCWS = The cost of planning the completion of work in a period of time

ACWP = Expenses incurred based on time

1. For work in the first week
   BCWS = IDR 20,557,107.13
   ACWP = IDR 17,558,968.67

BV = IDR 20,557,107.13 - IDR 17,558,968.67 = IDR 2,968,138.46
(This value indicates that the budget issued is smaller than the planned budget).

2. For work in the second week

BCWS = IDR 8,101,918.69
ACWP = IDR 24,976,335.50
BV = IDR 8,101,918.69 - IDR 24,976,335.50 = IDR -16,874,416.81
(This value indicates that the budget issued is greater than the planned budget). For the calculation of schedule deviations (BV) per week, it can be seen in table 5 and the schedule deviation graphs in figures 6 and 7.

Table 5
Analysis Schedule Varians (BV)

No.	Period	BCWS (IDR)	ACWP (IDR)	BV Monthly (IDR)	BV Cumulative (IDR)
1	Week 1	20,557,107.13	17,588,968.67	2,968,138.46	2,968,138.46
2	Week 2	8,101,918.69	24,976,335.50	-16,874,416.81	-13,906,278.35
3	Week 3	99,923,663.87	48,053,062.39	51,870,601.48	37,964,323.13
4	Week 4	187,029,366.83	69,546,782.10	117,482,584.73	155,446,907.86
5	Week 5	320,650,563.17	106,307,726.61	214,342,836.56	369,789,744.42
6	Week 6	97,343,948.47	116,861,107.81	-19,517,159.34	350,272,585.08
7	Week 7	309,203,076.06	140,746,927.26	168,456,148.81	518,728,733.88
8	Week 8	378,694,159.77	883,740,141.60	-505,045,981.83	13,682,752.05
9	Week 9	1,005,968,083.61	438,141,209.45	567,826,874.16	581,509,626.21
10	Week 10	631,909,349.95	664,546,414.10	-32,637,064.15	548,872,562.06
11	Week 11	594,946,865.17	429,944,750.05	165,002,115.12	713,874,677.18
12	Week 12	376,477,216.85	980,420,839.42	-603,943,622.57	109,931,054.61

Figure 6
Weekly Analysis Schedule Variance (BV) chart

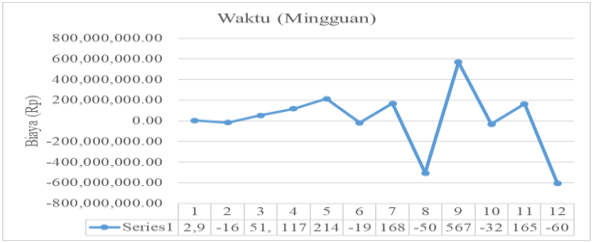


Figure 7
Cumulative Analysis Schedule Variance (BV) graph

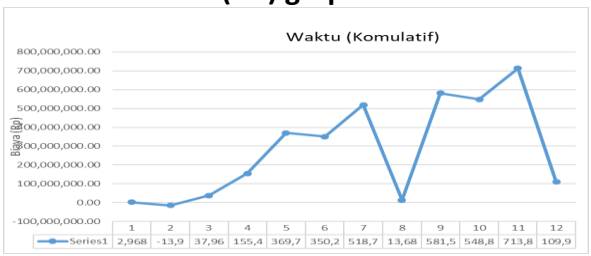


Table 6
SV, CV and BV Monthly Analysis

No	Period	Cumulative SV Rp	Cumulative CV Rp	Cumulative BV Rp

1	Month 1	-135.435.058,74	20.011.849,12	155.446.907,86
2	Month 2	197.267.612,34	210.950.364,39	13.682.752,05
3	Month 3	0,00	109.931.054,61	109.931.054,61

Source: Analysis Results

Information

a. In month 1 the SV (deviation against time) shows a value of Rp -135,435,058.74 (negative) meaning that globally in month 1, the implementation is behind schedule. In the 2nd month the SV value was IDR 197,267,612.34 (positive) meaning that globally the implementation in the 2nd month experiencedahead of schedule. In the 3rd month the SV value is IDR 0, - meaning that the implementation is completed according to the planned schedule.
b. The CV value (deviation from costs) in month 1 is Rp. 20,011,849.12 (positive) this value indicates that the budget issued in month 1 is lower by Rp. same job. This is because these expenses do not include taxes paid at the end of the job. In the 3rd month the CV value is IDR 109,931,054.61 (positive). In month 3, which is the last month of the project, it can be concluded that the project was completed at a cost below the planned budget of IDR 109,931,054.61 including tax.
c. The BV value in month 1 is IDR 155,446,907.86. This BV value represents the percentage of weight or achievement that has been completed. This means that in month 1 the weight of work completed is greater than the weight planned, therefore the project runs faster than planned.

2. Project Productivity and Performance

a. Time Performance Index (SPI)

To find out the efficiency of the project time, the next calculation is the time performance index or commonly known as (SPI). To display the SPI value for each period, the following formula is used:

SPI = BCWP / BCWS ……(4.4)

With:

SPI = Efficient use of resources
BCWP = Cost based on completion of work within the time period
BCWS = The cost of planning the completion of work in a period of time

If the SPI performance index value < 1 means that the time in implementing the project is slower than planned. If the SPI performance index value is > 1, it means that the time for implementation is faster than planned. The greater the difference from number 1, the greater the deviation from planning.

The monthly SPI value is obtained as follows:

1) For work in the first week of

BCWP = IDR 20,960,187.66
BCWS = IDR 20,557,107.13
SPI = 20.960.187,66/20.557.107,13=1,02
(This value indicates SPI (1.02) > 1, meaning that project implementation is faster than planning)

2) For work in the second week of

BCWP = IDR 29,424,878.83
BCWS = IDR 8,101,918.69

SPI = 29.424.878,83/ 8.101.918,69=3,63
(This value indicates SPI (3.63) > 1, meaning that project implementation is faster than planning).

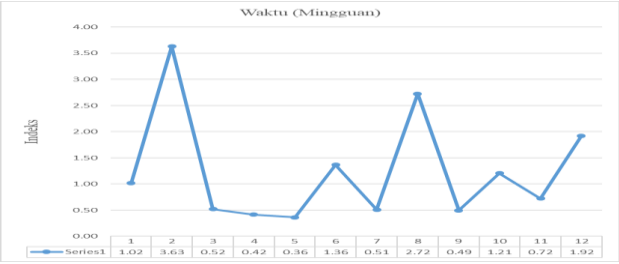
3) For work in the third week of
BCWP = IDR 51,997,388.62
BCWS = IDR 99,923,663.87
SPI = 51.997.388,62 / 99.923.663,87 = 0,52
(This value indicates SPI (0.52) > 1, meaning that the project implementation is behind schedule)

For weekly schedule deviation (SPI) calculations in the same way as above, it can be seen in table 6, and schedule deviation graphs in figure 6.

Table 7
Analysis Schedule Performance Index (SPI)

No	Period	BCWP (IDR)	BCWS (IDR)	SPI % Weekly (IDR)	Information
1	Week 1	20,960,187.66	20,557,107.13	1.02	Faster
2	Week 2	29,424,878.83	8,101,918.69	3.63	Faster
3	Week 3	51,997,388.62	99,923,663.87	0.52	Late
4	Week 4	77,794,542.67	187,029,366.83	0.42	Late
5	Week 5	116,288,733.47	320,650,563.17	0.36	Late
6	Week 6	132,815,035.28	97,343,948.47	1.36	Faster
7	Week 7	157,604,488.00	309,203,076.06	0.51	Late
8	Week 8	1,031,886,161.81	378,694,159.77	2.72	Faster
9	Week 9	496,998,295.90	1,005,968,083.61	0.49	Late
10	Week 10	761,822,205.40	631,909,349.95	1.21	Faster
11	Week 11	429,683,847.07	594,946,865.17	0.72	Late
12	Week 12	723,529,554.86	376,477,216.85	1.92	Faster

Figure 8
Weekly Analysis Schedule Performance Index (SPI) chart



b. Cost Performance Index (CPI)

In knowing the cost efficiency of the project, the next calculation is the cost performance index or commonly known as (CPI). To display the CPI value for each period, the following formula is used:

CPI = BCWP / ACWP .....(4.5)

With:

CPI = Cost efficiency
BCWP = Cost based on completion of work within the time period
ACWP = Expenses incurred based on time

The CPI weekly value is obtained as follows:

1) For work in the first week of
BCWP = IDR 20,960,187.66
ACWP = IDR 17,588,968.67
CPI = 20.960.187,66 / 17.588.968,67=1,19
This value shows CPI > 1, meaning that the expenditure is less than the planned budget

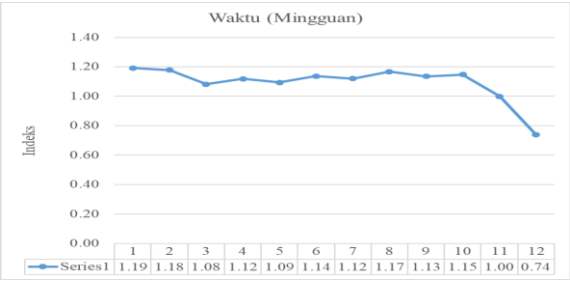
2) For work in the second week
BCWP = IDR 29,424,878.83
ACWP = IDR 24,976,335.50
CPI = 29.424.878,83 / 24.976.335,50 = 1.18
This value shows CPI > 1, meaning that the expenditure is less than the planned budget
3. For work in the third week of
BCWP = IDR 51,997,388.62
ACWP = IDR 48,053,062.39
CPI = 51.997.388,62 / 48.053.062,39=1,08
This value shows CPI > 1, meaning that the expenditure is less than the planned budget. For the calculation of schedule deviations (CPI) per week in the same way as above, it can be seen in table 6, and schedule deviation graphs in figures 7 and 8.

Table 8
Analysis Cost Performance Index (CPI)

No	Period	BCWP (IDR)	ACWP (IDR)	CPI % Weekly (IDR)	CPI % Cumulative (IDR)
1	Week 1	20,960,187.66	17,588,968.67	1.19	1.19
2	Week 2	29,424,878.83	24,976,335.50	1.18	2.37
3	Week 3	51,997,388.62	48,053,062.39	1.08	3.45
4	Week 4	77,794,542.67	69,546,782.10	1.12	4.57
5	Week 5	116,288,733.47	106,307,726.61	1.09	5.66
6	Week 6	132,815,035.28	116,861,107.81	1.14	6.80
7	Week 7	157,604,488.00	140,746,927.26	1.12	7.92
8	Week 8	1,031,886,161.81	883,740,141.60	1.17	9.09
9	Week 9	496,998,295.90	438,141,209.45	1.13	10.22
10	Week 10	761,822,205.40	664,546,414.10	1.15	11.37
11	Week 11	429,683,847.07	429,944,750.05	1.00	12.37
12	Week 12	723,529,554.86	980,420,839.42	0.74	13.11

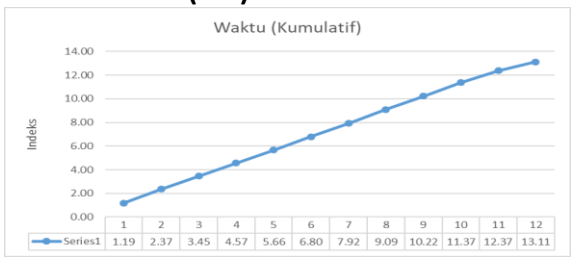
Source: Analysis Results

Figure 9
Weekly Analysis Cost Performance Index (CPI) chart



Source: Analysis Results Based on Equation 4.5

Figure 10
Grafik Analysis Cost Performance Index (CPI) Kumulatif



Source: Cumulative CPI Analysis Results Based on Equation 4.5

3. Project Analysis Results

From the project data and the results of the previous analysis, the following data were obtained:

a. Job completion time = 120 Days
b. Total Project budget (BAC) = IDR 4,030,805,319.57
c. BCWP (until 12th week) = IDR 4,030,805,319.57
d. ACWP (until 12th week) = IDR 3,920,874,264.96
e. BCWS (until 12th week) = IDR 4,030,805,319.57

Then based on the data above, the estimated time and cost of completion can be determined as follows:

Time and Cost Performance Analysis

1. Deviation from schedule:

SV = BCWP – BCWS = IDR 4,030,805,319.57 - IDR 4,030,805,319.57 = 0 (work completed with budget not exceeding planning).

2. Deviation from costs:

CV = BCWP – ACWP = IDR 4,030,805,319.57 - IDR 3,920,874,264.96 = IDR 109,931,054.61 (implementation costs are less than planning)

3. SPI time performance index = BCWP / BCWS = IDR 4,030,805,319.57 / IDR 4,030,805,319.57 = 1 = 1 (Implementation completed according to schedule)

4. CPI cost performance index = BCWP / ACWP = IDR 4,030,805,319.57 / IDR 3,920,874,264.96 = 1.03 > 1 (lower spending than planned)

Table 10
Results*Analysis Earned Value*

No	Minggu	BCWS Perencanaan	BCWP Realisasi	ACWP Aktual	Penyimpangan			Kinerja	
					SV (Waktu)	CV (Biaya)	BV (Aktual)	SPI (Waktu)	CPI (Biaya)
1	Minggu 1	20,557,107.13	20,960,187.66	17,588,968.67	403,080.53	3,371,219.00	2,968,138.46	1.02	1.19
2	Minggu 2	8,101,918.69	29,424,878.83	24,976,335.50	21,322,960.14	4,448,543.33	-16,874,416.81	3.63	1.18
3	Minggu 3	99,923,663.87	51,997,388.62	48,053,062.39	-47,926,275.25	3,944,326.23	51,870,601.48	0.52	1.08
4	Minggu 4	187,029,366.83	77,794,542.67	69,546,782.10	-109,234,824.16	8,247,760.57	117,482,584.73	0.42	1.12
5	Minggu 5	320,650,563.17	116,288,733.47	106,307,726.61	-204,361,829.70	9,981,006.86	214,342,836.56	0.36	1.09
6	Minggu 6	97,343,948.47	132,815,035.28	116,861,107.81	35,471,086.81	15,953,927.47	-19,517,159.34	1.36	1.14
7	Minggu 7	309,203,076.06	157,604,488.00	140,746,927.26	-151,598,588.07	16,857,560.74	168,456,148.81	0.51	1.12
8	Minggu 8	378,694,159.77	1,031,886,161.81	883,740,141.60	653,192,002.04	148,146,020.21	-505,045,981.83	2.72	1.17
9	Minggu 9	1,005,968,083.61	496,998,295.90	438,141,209.45	-508,969,787.70	58,857,086.46	567,826,874.16	0.49	1.13
10	Minggu 10	631,909,349.95	761,822,205.40	664,546,414.10	129,912,855.45	97,275,791.30	-32,637,064.15	1.21	1.15
11	Minggu 11	594,946,865.17	429,683,847.07	429,944,750.05	-165,263,018.10	-260,902.98	165,002,115.12	0.72	1.00
12	Minggu 12	376,477,216.85	723,529,554.86	980,420,839.42	347,052,338.01	-256,891,284.55	-603,943,622.57	1.92	0.74

CONCLUSION

Based on the results of the discussion, it can be concluded as follows: (1) Cumulative Time Deviation (SV) in week 12 is 0. It can be concluded that the project was completed according to the planned schedule. (2) Cumulative Cost Deviation (CV) in week 12 of IDR 109,931,054.61. This value represents the difference in costs incurred that are lower than the value that should have been incurred at the same work weight. (3) Cumulative Deviation from Budget (BV) in week 12 of 109,931,054.61. The budget issued is smaller than the cost of planning. (4) Cost and Time Performance Index: Cost Performance Index (In the Cost Performance Index or what can be called CPI, a value of 1.03 > 1 is obtained. It can be concluded that the costs incurred for the completion of the Sendiment Trap Check Dam construction project in Bandung Regency and Sumedang is smaller than the planned budget. Based on the analysis of the Sendiment Trap Check Dam construction project in Bandung and

Sumedang districts, it is smaller than the planned budget, experiencing a profit of IDR 109,931,054.61 from the planned budget, including 10% VAT) . Time Performance Index, Based on an analysis of the cost of the Sendiment Trap Check Dam construction project in Bandung and Sumedang Regencies, a Time Performance Index (SPI) of 1 = 1 is obtained, so the project implementation is completed according to the planning schedule, namely 120 days.

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