EVALUATION TIME AND COSTS OF BUILDING RENOVATION PROJECT BPJS SURAKARTA
(Study Case: BPJS Main Office in Surakarta Central Java)

To fulfill part of the requirements
Acheiving S-1 graduate degree of Civil Engineering

Submitted by:

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CIVIL ENGINEERING PROGRAM
ENGINEERING FACULTY
MUHAMMADIYAH SURAKARTA UNIVERSITY
2017

APPROVAL PAGE

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Scientific Publications

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CERTIFICATION SHEET

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Scientific Publications

Submitted and maintain in final project exam

In the presence of examiners

At Date, 2017

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STATEMENT

I hereby declare thats in Scientific Publication no work has ever been submitted for a degree at a college and to the best of my knowledge there is no work or opinion ever writtenor published by any other person, except in writing referred to in the text and mentioned in refference.

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Surakarta, 30 October 2017

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ABSTRACT

This research was conducted on a building renovation construction project BPJS Surakarta built by PT. Penta Electro Powerindo which acts as a contractor, the construction of the building renovation project BPJS Surakarta planned to begin in August 2016 and was completed in December 2016. But in its implementation, the project suffered a setback in the execution schedule that caused the project to incur additional costs (overrun) in order to achieve the planned schedule.

The final project is intended to examine the relationship between time and costs incurred in building renovation project BPJS Surakarta. Analysis of project progress carried out from the beginning of implementation 1st week until 22nd week completion. However, after examination at week 15 experienced a delay in the execution of this project (under schedule), starting week 15 to week 22 do rescheduling by using Precedence Diagram Method (PDM).

The result of the rescheduling analysis is 7 weeks remaining, the remaining cost is Rp. 3,386,547,544.25, the remaining volume 73,003.74, and the remaining weight 57, 69%. Then from the rescheduling of earlier researchers tried to accelerate the implementation (Crashing) with some alternative acceleration, alternative acceleration 1-3 with alternate acceleration time for 1 week, alternative acceleration 4-6 with alternate acceleration time for 2 weeks, and alternative acceleration 7-9 with the alternate acceleration time for 3 weeks, then from several alternatives had been accelerating the most optimal alternative kind of terms by cost and duration that is an alternatif acceleration 1st, with acceleration time for 1 week to 6 weeks of project implementation at the total cost of Rp. 3,463,474,131.30.

Keywords: ***control project, cost, crashing, PDM, rescheduling, time.***

ABSTRAK

Penelitian ini dilakukan pada proyek renovasi bangunan gedung BPJS Surakarta yang dibangun oleh PT. Penta Electro Powerindo yang bertindak sebagai kontraktor, pembangunan proyek renovasi gedung BPJS Surakarta direncanakan dimulai pada Agustus 2016 dan selesai pada bulan Desember 2016. Namun dalam pelaksanaannya, proyek tersebut mengalami kemunduran dalam jadwal pelaksanaan yang menyebabkan proyek tersebut dikenakan biaya tambahan (overrun) untuk mencapai jadwal yang direncanakan.

Tugas akhir ini dimaksudkan untuk menguji hubungan antara waktu dan biaya yang dikeluarkan dalam proyek renovasi gedung BPJS Surakarta. Analisis kemajuan proyek dilakukan sejak awal pelaksanaan 1 minggu sampai 22 minggu selesai. Namun, setelah pemeriksaan pada minggu ke 15 mengalami keterlambatan dalam pelaksanaan proyek ini (dalam jadwal), mulai minggu ke 15 hingga minggu 22 dilakukan penjadwalan ulang dengan menggunakan Precedence Diagram Method (PDM).

Hasil analisis penjadwalan ulang adalah 7 minggu tersisa, sisa biaya Rp. 3.386.547.544,25, sisa volume 73.003,74, dan berat sisanya 57, 69%. Kemudian dari penjadwalan ulang periset terdahulu mencoba mempercepat pelaksanaannya (Crashing) dengan beberapa percepatan alternatif, percepatan alternatif 1-3 dengan waktu akselerasi alternatif selama 1 minggu, percepatan alternatif 4-6 dengan waktu akselerasi alternatif selama 2 minggu, dan percepatan alternatif 7 -9 dengan waktu percepatan alternatif selama 3 minggu, maka dari beberapa alternatif telah mempercepat alternatif yang paling optimal dari segi biaya dan durasi yaitu percepatan alternatif 1, dengan waktu percepatan selama 1 minggu sampai 6 minggu pelaksanaan proyek di total biaya Rp. 3,463,474,131.30.

Kata kunci: ***pengendalian proyek, biaya, kejatuhan, PDM, penjadwalan ulang, waktu.***

1. INTRODUCTION

1.1 Background

Good project scheduling is an important component in the planning and control of a project, before beginning a project estimate the duration and cost of the project is a basic plan which is intended to complete the project to be on time and within the planned budget. When a project begins, actual performance is monitored and analysed to revise estimates of the remaining work, the main purpose of estimation of this work is to obtain a warning signal that corrective and preventive actions can be done in a proper way, these estimates need to be revised and compared with the time schedule completion and project budgets available.

This research was conducted on a building renovation construction project BPJS Surakarta built by PT. Penta Electro Powerindo which acts as a contractor, the construction of the building renovation project BPJS Surakarta planned to begin in August 2016 and was completed in December 2016. But in its implementation, the project suffered a setback in the execution schedule that caused the project to incur additional costs (overrun) in order to achieve the planned schedule, these problems an interesting study to investigate, the researchers wanted to evaluate how the control of management time and cost of completing the construction project by using the Precedence Diagram method (PDM) and the curve "S".

1.2 Problem Formulation

1. Has the plan time equal to the time plan for building renovation project implementation BPJS Surakarta?
2. Has the plan costs equal to the cost of the building renovation project implementation BPJS Surakarta?
3. How to evaluate the time and cost by using the Precedence Diagram Method (PDM) and the curve "S"?

1.3 Research Objectives

1. To know the time plan analysis and time implementation analysis.
2. To know the cost analysis plan and implementation cost analysis.
3. To know the analysis of time and cost evaluation by using the *Precedence Diagram Method* (PDM) and the curve "S".

2. LITERATURE REVIEW

Komesh Sahu and Meenu Sahu, M. Tech, Thermal Engineering Student, Government Engineering College, Jagdalpur an M. E, Production Engineering Student, Bhilai Institute of Technology Durg (2014), in a research titled "Cost and Time and Project Duration Minimum Also using alternative method ", stating that the time and cost plays an important role in every project, the research they provide approach alternative methods to obtain optimal cost and the minimum duration of the project time by pressing the full in the critical path, this method is done by directly minimizing slope values critical to shorten the duration of the project and suppress the full effectiveness of time.

3. THEORETICAL

3.1 The Curve "S"

Visualization the Curve "S" can provide information about the progress of the project by comparing it to the schedule plan. From this known whether there is any delay or accelerate the project schedule (Husen, 2009: 152).

Here are a few things that are on the Curve "S", among others:

1. Weight of activity (%).
2. Bar Chart.
3. Achievement plan.
4. Cumulative plan.

3.2 Precedence Diagram Method (PDM)

Precedence Diagram Method (PDM) may be referred to as node diagram (AON) or construction block diagram, in which the characteristics are:

1. Activities of not stated in the arrow, but entered the node, circles or squares.
2. An activity must be included in the symbol for the activity and duration.
3. Each node there are two events that start and finish events.
4. Node is divided into small parts that contains a description of the activity (name, duration, number, start and completion activity).
5. Arrows or connecting lines have no duration, so that the Precedence Diagram Method (PDM) is not required dummy anymore.
6. Constraints (mark) shows the relationship between activities with a line from the previous node to the next node.
7. One constraint can only connect two nodes.
8. The complement of the Arrow Diagram Method (ADM) because in this diagram can be described their overlapping relationship or constraints, among others:
   1) Start to Start (SS)
      The relationship between the start of an activity with the onset of previous activities.
   2) Start to Finish (SF)
      The relationship between the completions of an activity with the onset of previous activities.
   3) Finish to Start (FS)
      The relationship between the start of an activity with the completion of the previous activity.
   4) Finish to Finish (FF)
      The relationship between the completions of an activity with the completion of the previous activity.

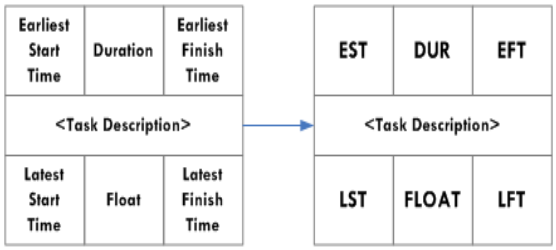


Figure III.1 Node of Precedence Diagram Method (AON)

3.3 Crashing Project

Advantages crashing:

1. To reduce the duration of the work.
2. To minimize the cost of the work.

Disadvantages crashing:

1. Unable to analyse the quality of the work.
2. Workers build up can be risky if not done carefully.

3.4 Analysis of Cost Variance (CV) and the Integrated Schedule (SV).

According to Suharto (2001), analysing the progress of the project with a simple variance method is still insufficient, because the analysis of variance did not integrate aspects of the schedule fee. Therefore, the result value method is used (Earned Value Method) with indicator ACWP, BCWP and BCWS. The definition of the indicator with the result value method (EVM), among others:

1) ACWP (Actual Cost of Work Performed)
   The actual amount of budget used for any activities carried out within a certain time.
2) BCWP (Budgeted Cost of Work Performed)
   Total budget worth for any activities that have been implemented.
3) BCWS (Budgeted Cost of Work Scheduled)
   The planned budget for each activity to be undertaken.

Cost variance

(CV)= BCWP-ACWP

Schedule variance

(SV)= BCWP-BCWS

3.4 Productivity and Performance Index

Productivity index can be explained as follows:

Index productivity schedule (SPI).

SPI = BCWP / BCWS

Description as follows:

SPI = 1 (the project on time)

SPI> 1 (project faster)

SPI <1 (the project is late)

Cost productivity index (CPI).

CPI = BCWP / ACWP

Description as follows:

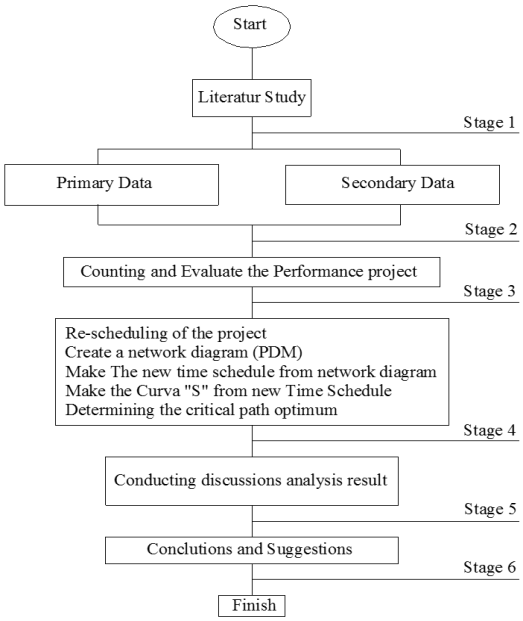
CPI=1(cost according to the budget plan)

CPI> 1 (cost less or saving)

CPI <1 (the cost is greater or wasteful)

SPI *(*Schedule Performance Index) and CPI *(*Cost Performance Index) is calculated for each item or work activities and the level above. At a higher level, SPI and CPI calculation is done by summation parameters below it.

4. METHODOLOGY



5. ANALYSIS AND DISCUSSION

5.1 General

Project construction of building renovation BPJS built by the company PT. Penta Powerindo Electro which acts as a contractor, the construction of the building renovation project BPJS Surakarta planned to begin in August 2016 and was completed in December 2016 with a total time for 22 weeks, at the beginning of the project contract cost of Rp. 5,453,406,086.19 + PPN 10% to Rp. 5,998,746,694.81 but in the implementation this project experienced Change Contract Order (CCO) that cause changes in contract value of Rp. 5,989,241,997.65 + PPN 10% to Rp. 6,588,166,197.42.

5.2 Analysis of Project Implementation

According to the project building renovation of BPJS Surakarta, analysis of cost and time to this project are carried out from week-1 to week-15, due to the 15th week of this project experienced a decrease in the percentage of job performance, which was originally the initial project plan at week-15 amounted to 43,78% but on the implementation became 42,60%, of course this is caused by many things such as delays in the progress of the project, cost reduction projects, and so forth. Analysis of the implementation on the projects carried out by researchers at the project building renovation BPJS in Surakarta, among others:

1. Analysis weights plan and weights implementation.

Analysis of job weight is carried out to know the development of project work that occur each week, an analysis of the implementation of the project building renovation BPJS in Surakarta which occurred at week 1 through week 22 can be seen in the table V.2 below:

Time	Weight	Weight	Performance	
(Week)	Planning Cumulative	Performance Cumulative	Fast	Slow
1	0.11%	0.02%	-	-0.09%
2	0.23%	0.18%	-	-0.05%
3	1.49%	1.92%	0.43%	-
4	2.75%	4.02%	1.27%	-
5	4.02%	5.46%	1.44%	-
6	4.84%	10.24%	5.40%	-
7	6.81%	15.68%	8.87%	-
8	8.77%	19.08%	10.31%	-
9	9.65%	20.14%	10.49%	-
10	10.65%	24.61%	13.96%	-
11	14.37%	28.50%	14.13%	-
12	18.60%	32.26%	13.66%	-
13	24.82%	35.54%	10.72%	-
14	32.99%	39.64%	6.65%	-
15	43.78%	42.60%	-	-1.18%
16	56.25%	48.57%	-	-7.68%
17	69.87%	53.44%	-	-16.43%
18	82.24%	60.17%	-	-22.07%
19	88.45%	70.82%	-	-17.63%
20	92.25%	76.10%	-	-16.15%
21	96.04%	88.80%	-	-7.24%
22	100%	100%	-	-

Table V.2 Analysis Weight Plan and Weight project implementation

2. Analysis of Actual Cost of Work Performance (ACWP)

Analysis ACWP obtained from weekly reports based expenditure project cost budget actually implemented in each week, this analysis is done from week 1 to week 22 of the project. ACWP analysis can be seen in the following table:

Time	ACWP	ACWP
(Week)		Cumulative
1	Rp 1,025,000.00	Rp 1,025,000.00
2	Rp 8,862,500.00	Rp 9,887,500.00
3	Rp 94,725,000.00	Rp 104,612,500.00
4	Rp 114,769,724.56	Rp 219,382,224.56
5	Rp 61,543,325.02	Rp 280,925,549.58
6	Rp 277,363,308.03	Rp 558,288,857.61
7	Rp 296,741,287.76	Rp 855,030,145.37
8	Rp 185,474,012.19	Rp 1,040,504,157.56
9	Rp 57,394,175.86	Rp 1,097,898,333.42
10	Rp 258,784,471.47	Rp 1,356,682,804.89
11	Rp 211,077,359.84	Rp 1,567,760,164.73
12	Rp 191,173,561.27	Rp 1,758,933,726.00
13	Rp 179,311,901.20	Rp 1,938,245,627.20
14	Rp 223,504,115.46	Rp 2,161,749,742.66
15	Rp 161,209,847.46	Rp 2,322,959,590.12
16	Rp 338,033,911.35	Rp 2,660,993,501.47
17	Rp 253,137,738.53	Rp 2,914,131,240.00
18	Rp 338,927,182.13	Rp 3,253,058,422.13
19	Rp 550,250,658.00	Rp 3,803,309,080.13
20	Rp 697,323,230.43	Rp 4,500,632,310.56
21	Rp 657,851,619.34	Rp 5,158,483,929.90
22	Rp 830,758,067.75	Rp 5,989,241,997.65

Table V.3 Analysis of Actual Cost of Work Performance (ACWP)

3. Analysis of Budget Cost of Work Schedule (BCWS)

Analysis of BCWS obtained from the weekly report on the value of the project contract budget of Rp. 5,989,241,997.72 multiplied by the weight of the project plan every week. BCWS analysis results can be seen in the following table:

Time (Week)	Contract (Rp)	Weight planning (%)	BCWS	BCWS Cumulative
1	Rp 5,989,241,997.65	0.11%	Rp 6,588,166.20	Rp 6,588,166.20
2	Rp 5,989,241,997.65	0.11%	Rp 6,588,166.20	Rp 13,176,332.39
3	Rp 5,989,241,997.65	1.26%	Rp 75,464,449.17	Rp 88,640,781.57
4	Rp 5,989,241,997.65	1.26%	Rp 75,464,449.17	Rp 164,105,230.74
5	Rp 5,989,241,997.65	1.26%	Rp 75,464,449.17	Rp 239,569,679.91
6	Rp 5,989,241,997.65	0.82%	Rp 49,111,784.38	Rp 288,681,464.29
7	Rp 5,989,241,997.65	1.97%	Rp 117,988,067.35	Rp 406,669,531.64
8	Rp 5,989,241,997.65	1.97%	Rp 117,988,067.35	Rp 524,657,598.99
9	Rp 5,989,241,997.65	0.88%	Rp 52,705,329.58	Rp 577,362,928.57
10	Rp 5,989,241,997.65	1.00%	Rp 59,892,419.98	Rp 637,255,348.55
11	Rp 5,989,241,997.65	3.72%	Rp 222,799,802.31	Rp 860,055,150.86
12	Rp 5,989,241,997.65	4.23%	Rp 253,344,936.50	Rp 1,113,400,087.36
13	Rp 5,989,241,997.65	6.22%	Rp 372,530,852.25	Rp 1,485,930,939.62
14	Rp 5,989,241,997.65	8.17%	Rp 489,321,071.21	Rp 1,975,252,010.82
15	Rp 5,989,241,997.65	10.79%	Rp 646,239,211.55	Rp 2,621,491,222.37
16	Rp 5,989,241,997.65	12.47%	Rp 746,858,477.11	Rp 3,368,349,699.48
17	Rp 5,989,241,997.65	13.62%	Rp 815,734,760.08	Rp 4,184,084,459.56
18	Rp 5,989,241,997.65	12.37%	Rp 740,869,235.11	Rp 4,924,953,694.67
19	Rp 5,989,241,997.65	6.21%	Rp 371,931,928.05	Rp 5,296,885,622.72
20	Rp 5,989,241,997.65	3.80%	Rp 227,591,195.91	Rp 5,524,476,818.63
21	Rp 5,989,241,997.65	3.80%	Rp 227,591,195.91	Rp 5,752,068,014.54
22	Rp 5,989,241,997.65	3.96%	Rp 237,173,983.11	Rp 5,989,241,997.65

Table V.4 Analysis of *Budget Cost of Work Schedule* (BCWS)

4. Analysis of *Budget Cost of Work Performance* (BCWP)

Analysis BCWP obtained from a weekly report on the value of the contract budget of Rp. 5,989,241,997.65 multiplied by the weight of implementation of the work every week. In this case the analysis is done from week 1 to week 22 of the project, the results of the analysis are shown in Table BCWP V.5 and then the relationship of the three results is presented in the chart above V.1, as follows:

Time (Week)	Contract (Rp)	Weight Performance (%)	BCWP	BCWP Cumulative
1	Rp 5,989,241,997.65	0.02%	Rp 1,197,848.40	Rp 1,197,848.40
2	Rp 5,989,241,997.65	0.16%	Rp 9,582,787.20	Rp 10,780,635.60
3	Rp 5,989,241,997.65	1.74%	Rp 104,212,810.76	Rp 114,993,446.35
4	Rp 5,989,241,997.65	2.10%	Rp 125,774,081.95	Rp 240,767,528.31
5	Rp 5,989,241,997.65	1.44%	Rp 86,245,084.77	Rp 327,012,613.07
6	Rp 5,989,241,997.65	4.78%	Rp 286,285,767.49	Rp 613,298,380.56
7	Rp 5,989,241,997.65	5.44%	Rp 325,814,764.67	Rp 939,113,145.23
8	Rp 5,989,241,997.65	3.40%	Rp 203,634,227.92	Rp 1,142,747,373.15
9	Rp 5,989,241,997.65	1.06%	Rp 63,485,965.18	Rp 1,206,233,338.33
10	Rp 5,989,241,997.65	4.47%	Rp 267,719,117.29	Rp 1,473,952,455.62
11	Rp 5,989,241,997.65	4.14%	Rp 247,954,618.70	Rp 1,721,907,074.32
12	Rp 5,989,241,997.65	3.51%	Rp 210,222,394.12	Rp 1,932,129,468.44
13	Rp 5,989,241,997.65	3.28%	Rp 196,447,137.52	Rp 2,128,576,605.96
14	Rp 5,989,241,997.65	4.10%	Rp 245,558,921.90	Rp 2,374,135,527.87
15	Rp 5,989,241,997.65	2.96%	Rp 177,281,563.13	Rp 2,551,417,091.00
16	Rp 5,989,241,997.65	5.97%	Rp 357,557,747.26	Rp 2,908,974,838.26
17	Rp 5,989,241,997.65	4.87%	Rp 291,676,085.29	Rp 3,200,650,923.54
18	Rp 5,989,241,997.65	6.73%	Rp 403,075,986.44	Rp 3,603,726,909.99
19	Rp 5,989,241,997.65	10.65%	Rp 637,854,272.75	Rp 4,241,581,182.74
20	Rp 5,989,241,997.65	5.28%	Rp 316,231,977.48	Rp 4,557,813,160.21
21	Rp 5,989,241,997.65	12.70%	Rp 760,633,733.70	Rp 5,318,446,893.91
22	Rp 5,989,241,997.65	11.20%	Rp 670,795,103.74	Rp 5,989,241,997.65

Table V .5 analysis of *Budget Cost of Work Performance* (BCWP)

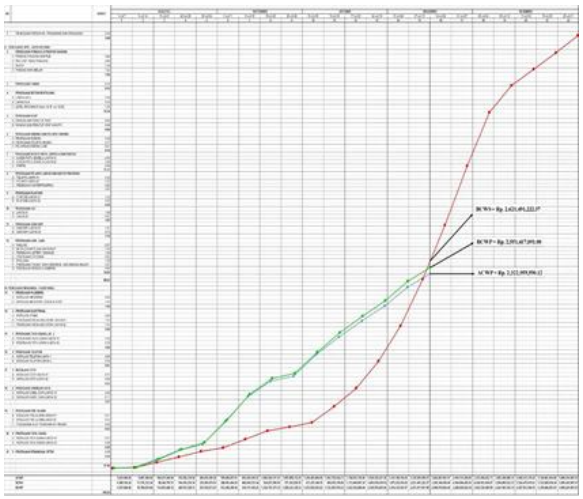


Figure V.1 Graph of relationship analysis, ACWP, BCWS, and BCWP

5. analysis of *Cost Variance* (CV) and the *Schedule Variance* (SV)

In the project of building renovation BPJS in Surakarta, analysis *Cost Variance* (CV) and the *Schedule Variance* (SV) carried out starting from week 1 up to the 22nd week of project implementation, the analysis was intended to determine the use of project budgets and to identify the implementation of the work within a specific time period. Results of analysis of CV and SV can be seen in the table and figure below:

Time	ACWP	BCWS	BCWP	SV	CV
(Week)	Cumulative	Cumulative	Cumulative		
1	2	3	4	5 = 4 - 3	6 = 4 - 2
1	Rp 1,025,000.00	Rp 6,588,166.20	Rp 1,197,848.40	-Rp 5,390,317.80	Rp 172,848.40
2	Rp 9,887,500.00	Rp 13,176,332.39	Rp 10,780,635.60	-Rp 2,395,696.80	Rp 893,135.60
3	Rp 104,612,500.00	Rp 88,640,781.57	Rp 114,993,446.35	Rp 26,352,664.79	Rp 10,380,946.35
4	Rp 219,382,224.56	Rp 164,105,230.74	Rp 240,767,528.31	Rp 76,662,297.57	Rp 21,385,303.75
5	Rp 280,925,549.58	Rp 239,569,679.91	Rp 327,012,613.07	Rp 87,442,933.17	Rp 46,087,063.49
6	Rp 558,288,857.61	Rp 288,681,464.29	Rp 613,298,380.56	Rp 324,616,916.27	Rp 55,009,522.95
7	Rp 855,030,145.37	Rp 406,669,531.64	Rp 939,113,145.23	Rp 532,443,613.59	Rp 84,082,999.86
8	Rp 1,040,504,157.56	Rp 524,657,598.99	Rp 1,142,747,373.15	Rp 618,089,774.16	Rp 102,243,215.59
9	Rp 1,097,898,333.42	Rp 577,362,928.57	Rp 1,206,233,338.33	Rp 628,870,409.75	Rp 108,335,004.91
10	Rp 1,356,682,804.89	Rp 637,255,348.55	Rp 1,473,952,455.62	Rp 836,697,107.07	Rp 117,269,650.73
11	Rp 1,567,760,164.73	Rp 860,055,150.86	Rp 1,721,907,074.32	Rp 861,851,923.46	Rp 154,146,909.59
12	Rp 1,758,933,726.00	Rp 1,113,400,087.36	Rp 1,932,129,468.44	Rp 818,729,381.08	Rp 173,195,742.44
13	Rp 1,938,245,627.20	Rp 1,485,930,939.62	Rp 2,128,576,605.96	Rp 642,645,666.35	Rp 190,330,978.76
14	Rp 2,161,749,742.66	Rp 1,975,252,010.82	Rp 2,374,135,527.87	Rp 398,883,517.04	Rp 212,385,785.21
15	Rp 2,322,959,590.12	Rp 2,621,491,222.37	Rp 2,551,417,091.00	-Rp 70,074,131.37	Rp 228,457,500.88
16	Rp 2,660,993,501.47	Rp 3,368,349,699.48	Rp 2,908,974,838.26	-Rp 459,374,861.22	Rp 247,981,336.79
17	Rp 2,914,131,240.00	Rp 4,184,084,459.56	Rp 3,200,650,923.54	-Rp 983,433,536.01	Rp 286,519,683.54
18	Rp 3,253,058,422.13	Rp 4,924,953,694.67	Rp 3,603,726,909.99	-Rp 1,321,226,784.68	Rp 350,668,487.86
19	Rp 3,803,309,080.13	Rp 5,296,885,622.72	Rp 4,241,581,182.74	-Rp 1,055,304,439.99	Rp 438,272,102.61
20	Rp 4,500,632,310.56	Rp 5,524,476,818.63	Rp 4,557,813,160.21	-Rp 966,663,658.42	Rp 57,180,849.65
21	Rp 5,158,483,929.90	Rp 5,752,068,014.54	Rp 5,318,446,893.91	-Rp 433,621,120.63	Rp 159,962,964.01
22	Rp 5,989,241,997.65	Rp 5,989,241,997.65	Rp 5,989,241,997.65	Rp -	Rp -

Table V.6 Cost Analysis of Variance (CV) and the Schedule Variance (SV)

Time (Week)	SV	CV	Information
1	-5390317.80	172,848.40	Work is overhead than the plan at a cost lower than the budget
2	-2395696.80	893,135.60	Work is overhead than the plan at a cost lower than the budget
3	26,352,664.79	10,380,946.35	Work done faster than the schedule of plans at a cost smaller than the budget
4	76,642,297.57	21,385,303.75	Work done faster than the schedule of plans at a cost smaller than the budget
5	87,442,935.17	46,087,063.49	Work done faster than the schedule of plans at a cost smaller than the budget
6	324,616,936.27	55,009,522.95	Work done faster than the schedule of plans at a cost smaller than the budget
7	532,448,613.59	84,082,999.86	Work done faster than the schedule of plans at a cost smaller than the budget
8	638,089,774.16	102,243,215.59	Work done faster than the schedule of plans at a cost smaller than the budget
9	628,870,409.75	108,335,004.91	Work done faster than the schedule of plans at a cost smaller than the budget
10	836,697,107.07	117,269,650.73	Work done faster than the schedule of plans at a cost smaller than the budget
11	861,851,923.46	154,146,909.59	Work done faster than the schedule of plans at a cost smaller than the budget
12	838,729,381.08	173,195,742.44	Work done faster than the schedule of plans at a cost smaller than the budget
13	642,645,666.35	190,330,978.76	Work done faster than the schedule of plans at a cost smaller than the budget
14	398,885,517.04	212,385,785.21	Work done faster than the schedule of plans at a cost smaller than the budget
15	-700741313.37	228,457,500.88	Work is overhead than the plan at a cost lower than the budget
16	-459374861.22	247,981,336.79	Work is overhead than the plan at a cost lower than the budget
17	-985433536.01	286,519,683.54	Work is overhead than the plan at a cost lower than the budget
18	-1321226784.68	350,668,487.86	Work is overhead than the plan at a cost lower than the budget
19	-1055304439.99	438,272,102.61	Work is overhead than the plan at a cost lower than the budget
20	-986665658.42	57,180,849.65	Work is overhead than the plan at a cost lower than the budget
21	-433621120.63	159,962,964.01	Work is overhead than the plan at a cost lower than the budget
22	-	-	Work is done according schedule and budget

Table V. 7 Description Relation between *Cost Variance* (CV) and the *Schedule Variance* (SV)

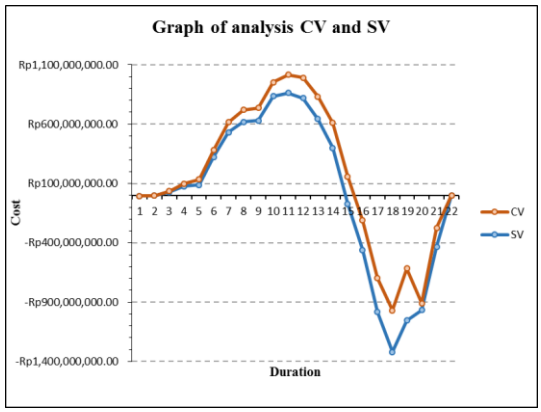


Figure V.2 CV and SV Graph analysis

6. Analysis of Cost Performance Index (CPI) and Schedule Performance Index (SPI)

analysis of CPI and SPI conducted starting in week 1 to week 22 of the project, this analysis aims to determine the level of field project progress in terms of both cost and time. The results of this analysis can be seen in the table and figure below:

Time (week)	ACWP Cumulative	BCWS Cumulative	BCWP Cumulative	SPI
1	2	3	4	5 = 4 / 3
1	Rp 1,025,000.00	Rp 6,588,166.20	Rp 1,197,848.40	0.18
2	Rp 9,887,500.00	Rp 13,176,332.39	Rp 10,780,635.60	0.82
3	Rp 104,612,500.00	Rp 88,640,781.57	Rp 114,993,446.35	1.30
4	Rp 219,382,224.56	Rp 164,105,230.74	Rp 240,767,528.31	1.47
5	Rp 280,925,549.58	Rp 239,569,679.91	Rp 327,012,613.07	1.37
6	Rp 558,288,857.61	Rp 288,681,464.29	Rp 613,298,380.56	2.12
7	Rp 855,030,145.37	Rp 406,669,531.64	Rp 939,113,145.23	2.31
8	Rp 1,040,504,157.56	Rp 524,657,598.99	Rp 1,142,747,373.15	2.18
9	Rp 1,097,898,333.42	Rp 577,362,928.57	Rp 1,206,233,338.33	2.09
10	Rp 1,356,682,804.89	Rp 637,255,348.55	Rp 1,473,952,455.62	2.31
11	Rp 1,567,760,164.73	Rp 860,055,150.86	Rp 1,721,907,074.32	2.00
12	Rp 1,758,933,726.00	Rp 1,113,400,087.36	Rp 1,932,129,468.44	1.74
13	Rp 1,938,245,627.20	Rp 1,485,930,939.62	Rp 2,128,576,605.96	1.43
14	Rp 2,161,749,742.66	Rp 1,975,252,010.82	Rp 2,374,135,527.87	1.20
15	Rp 2,322,959,590.12	Rp 2,621,491,222.37	Rp 2,551,417,091.00	0.97
16	Rp 2,660,993,501.47	Rp 3,368,349,699.48	Rp 2,908,974,838.26	0.86
17	Rp 2,914,131,240.00	Rp 4,184,084,459.56	Rp 3,200,650,923.54	0.76
18	Rp 3,253,058,422.13	Rp 4,924,953,694.67	Rp 3,603,726,909.99	0.73
19	Rp 3,803,309,080.13	Rp 5,296,885,622.72	Rp 4,241,581,182.74	0.80
20	Rp 4,500,632,310.56	Rp 5,524,476,818.63	Rp 4,557,813,160.21	0.83
21	Rp 5,158,483,929.90	Rp 5,752,068,014.54	Rp 5,318,446,893.91	0.92
22	Rp 5,989,241,997.65	Rp 5,989,241,997.65	Rp 5,989,241,997.65	1.00

Table V.8 Analysis Schedule Performance Index (SPI)

Time (Week)	ACWP Cumulative	BCWS Cumulative	BCWP Cumulative	CPI
1	2	3	4	5 = 4 / 2
1	Rp 1,025,000.00	Rp 6,588,166.20	Rp 1,197,848.40	Rp1.17
2	Rp 9,887,500.00	Rp 13,176,332.39	Rp 10,780,635.60	Rp1.09
3	Rp 104,612,500.00	Rp 88,640,781.57	Rp 114,993,446.35	Rp1.10
4	Rp 219,382,224.56	Rp 164,105,230.74	Rp 240,767,528.31	Rp1.10
5	Rp 280,925,549.58	Rp 239,569,679.91	Rp 327,012,613.07	Rp1.16
6	Rp 558,288,857.61	Rp 288,681,464.29	Rp 613,298,380.56	Rp1.10
7	Rp 855,030,145.37	Rp 406,669,531.64	Rp 939,113,145.23	Rp1.10
8	Rp 1,040,504,157.56	Rp 524,657,598.99	Rp 1,142,747,373.15	Rp1.10
9	Rp 1,097,898,333.42	Rp 577,362,928.57	Rp 1,206,233,338.33	Rp1.10
10	Rp 1,356,682,804.89	Rp 637,255,348.55	Rp 1,473,952,455.62	Rp1.09
11	Rp 1,567,760,164.73	Rp 860,055,150.86	Rp 1,721,907,074.32	Rp1.10
12	Rp 1,758,933,726.00	Rp 1,113,400,087.36	Rp 1,932,129,468.44	Rp1.10
13	Rp 1,938,245,627.20	Rp 1,485,930,939.62	Rp 2,128,576,605.96	Rp1.10
14	Rp 2,161,749,742.66	Rp 1,975,252,010.82	Rp 2,374,135,527.87	Rp1.10
15	Rp 2,322,959,590.12	Rp 2,621,491,222.37	Rp 2,551,417,091.00	Rp1.10
16	Rp 2,660,993,501.47	Rp 3,368,349,699.48	Rp 2,908,974,838.26	Rp1.09
17	Rp 2,914,131,240.00	Rp 4,184,084,459.56	Rp 3,200,650,923.54	Rp1.10
18	Rp 3,253,058,422.13	Rp 4,924,953,694.67	Rp 3,603,726,909.99	Rp1.11
19	Rp 3,803,309,080.13	Rp 5,296,885,622.72	Rp 4,241,581,182.74	Rp1.12
20	Rp 4,500,632,310.56	Rp 5,524,476,818.63	Rp 4,557,813,160.21	Rp1.01
21	Rp 5,158,483,929.90	Rp 5,752,068,014.54	Rp 5,318,446,893.91	Rp1.03
22	Rp 5,989,241,997.65	Rp 5,989,241,997.65	Rp 5,989,241,997.65	Rp1.00

Table V.9 Analysis of Cost Performance Index (CPI)

Time (Week)	SPI	CPI	Information
1	0.18	1.17	The project is late for a smaller or less costly
2	0.82	1.09	The project is late for a smaller or less costly
3	1.30	1.10	Faster project with smaller or lower cost
4	1.47	1.10	Faster project with smaller or lower cost
5	1.37	1.16	Faster project with smaller or lower cost
6	2.12	1.10	Faster project with smaller or lower cost
7	2.31	1.10	Faster project with smaller or lower cost
8	2.18	1.10	Faster project with smaller or lower cost
9	2.09	1.10	Faster project with smaller or lower cost
10	2.31	1.09	Faster project with smaller or lower cost
11	2.00	1.10	Faster project with smaller or lower cost
12	1.74	1.10	Faster project with smaller or lower cost
13	1.43	1.10	Faster project with smaller or lower cost
14	1.20	1.10	Faster project with smaller or lower cost
15	0.97	1.10	The project is late for a smaller or less costly
16	0.86	1.09	The project is late for a smaller or less costly
17	0.76	1.10	The project is late for a smaller or less costly
18	0.73	1.11	The project is late for a smaller or less costly
19	0.80	1.12	The project is late for a smaller or less costly
20	0.83	1.01	The project is late for a smaller or less costly
21	0.92	1.03	The project is late for a smaller or less costly
22	1.00	1.00	project on time with cost according to plan budget

Table V.10 Specification analysis results CPI and SPI

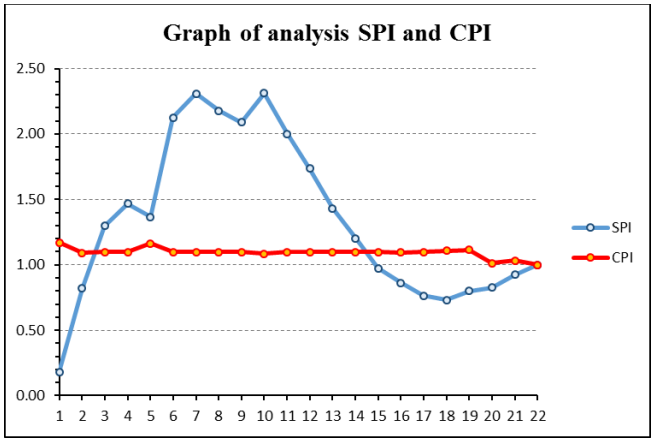


Figure V. 3 Graphic analysis of CPI and SPI

5.3 Rescheduling

In this final project researchers conducted the evaluation process time and cost of the project by using a network of Precedence Diagram Method (PDM) to reschedule the project. The rest of the weight of the work that is less than 0.05% is negligible, due to be considered complete when the rescheduling.

Of the process of rescheduling project got a new job list, the curve "S" new, new jobs logical relationships and to establish networks with methods Precedence Diagram Method (PDM) contained in the table and figure below:

No	Activity	Budget Plan (Rp)	Budget Performance (Rp)	Weight Plan (%)	Weight Performance (%)	Volume Plan	Volume Performance	Volume Rest	Weight Rest (%)	Budget Rest (Rp)
1	2	3	4	5	6	7	8	9	10=(5-6)	11=(4-8)
1	Preparation, Infrastructure and Support	148,250,000.00	111,187,500.00	2.475	1.856	10.00	7.72	2.28	0.619	37,062,500.00
	Roof Work									
2.1	Frame and Roof Coverings	515,245,847.11	396,739,302.27	8.603	6.624	21,552.00	16,127.14	5,424.86	1.979	118,506,544.84
2.2	Frame and Roof Cover of canopy	28,692,741.51	22,093,410.96	0.479	0.369	567.58	265.70	301.88	0.110	6,599,330.55
3	Wall work and Coatings									
3.1	Wall 1&2	321,242,211.13	186,320,482.46	5.364	3.111	3,681.03	3,212.49	468.54	2.253	134,921,728.67
3.2	Coating 1&2	166,104,783.08	96,349,774.19	2.773	1.609	811.09	0.00	811.09	1.165	69,754,008.89
3.3	The outer wall coating	24,309,750.00	14,099,655.00	0.406	0.235	95.47	22.62	72.85	0.170	10,210,095.00
4	door frame, windows and partitions									
4.1	1st Floor	269,355,918.82	269,355.92	4.497	0.004	399.28	0.00	399.28	4.493	269,086,562.90
4.2	2nd Floor	220,861,858.08	220,861.86	3.688	0.004	955.69	0.00	955.69	3.684	220,640,996.22
4.3	Partitions	178,925,588.96	178,925.59	2.987	0.003	1,538.82	3.80	1,535.02	2.984	178,746,663.37
	Floor coating and Water Proofing									
5.1	1st Floor	260,462,776.82	15,627,766.61	4.349	0.261	887.56	40.97	846.59	4.088	244,835,010.21
5.2	2nd Floor	153,430,986.70	9,205,859.20	2.562	0.154	838.40	1.78	836.62	2.408	144,225,127.50
5.3	Water Proofing	15,288,590.00	917,315.40	0.255	0.015	57.55	0.00	57.55	0.240	14,371,274.60
6	Ceiling									
6.1	1st Floor	72,782,708.39	28,385,256.27	1.215	0.474	879.28	435.71	443.57	0.741	44,397,452.12
6.2	2nd Floor	199,215,765.73	77,694,148.63	3.326	1.297	1,110.98	141.14	969.84	2.029	121,521,617.10
	Paint work									
7.1	1st Floor	59,747,725.44	5,377,295.29	0.998	0.090	1,506.27	152.40	1,353.87	0.908	54,370,430.15
7.2	2nd Floor	57,975,395.92	5,217,785.63	0.968	0.087	1,542.59	110.90	1,431.69	0.881	52,757,610.29
8	Sanitary work									
8.1	1st Floor	60,274,000.00	602,740.00	1.006	0.010	49.00	0.20	48.80	0.996	59,671,260.00
8.2	2nd Floor	44,010,000.00	440,100.00	0.735	0.007	34.00	0.00	34.00	0.727	43,569,900.00
9	Other works									
9.1	Railing	16,121,250.00	5,158,800.00	0.269	0.086	54.90	0.00	54.90	0.183	10,962,450.00
9.2	counter table and backdrop	144,900,000.00	46,368,000.00	2.419	0.774	9.00	0.00	9.00	1.645	98,532,000.00
9.3	Letter signage work	71,800,000.00	22,976,000.00	1.199	0.384	4.00	0.00	4.00	0.815	48,824,000.00
9.4	External work	362,597,371.82	116,031,158.98	6.054	1.937	2,649.40	704.09	1,945.31	4.117	246,566,212.84
9.5	Security Post	81,344,537.71	26,030,252.00	1.358	0.435	301.27	208.44	92.83	0.924	55,314,285.71
9.6	fences, poles and billboards	207,930,927.80	66,537,896.90	3.472	1.111	1,491.23	940.90	550.33	2.361	141,393,030.90
9.7	Side pergola Work	3,890,905.00	1,245,089.60	0.065	0.021	83.99	58.74	25.25	0.044	2,645,815.40
10	Plumbing work									
10.1	Installation of clean water 1&2	32,306,750.00	20,999,387.50	0.539	0.351	308.00	224.70	83.30	0.189	11,307,362.50
10.2	Installation of dirty water 1&2	62,396,250.00	40,557,562.50	1.042	0.677	194.00	140.40	53.60	0.365	21,838,687.50
11	Elektrikal work									
11.1	Main installation	122,349,000.00	6,117,450.00	2.043	0.102	53,076.00	0.00	53,076.00	1.941	116,231,550.00
11.2	1st Floor	117,711,700.00	5,885,585.00	1.965	0.098	317.00	65.20	251.80	1.867	111,826,115.00
11.3	2nd Floor	92,446,800.00	4,622,340.00	1.544	0.077	319.00	0.00	319.00	1.466	87,824,460.00
12	Air conditioner work(AC)									
12.1	1st Floor	153,331,160.00	1,533,311.60	2.560	0.026	58.00	3.60	54.40	2.535	151,797,848.40
12.2	2nd Floor	138,863,327.27	1,388,633.27	2.319	0.023	46.00	0.00	46.00	2.295	137,474,694.00
13	Telephon work									
13.1	1st Floor	38,870,000.00	1,166,100.00	0.649	0.019	30.00	5.40	24.60	0.630	37,703,900.00
13.2	2nd Floor	9,710,000.00	291,300.00	0.162	0.005	21.00	0.00	21.00	0.157	9,418,700.00
14	Installation of CCTV									
14.1	1st Floor	16,000,000.00	480,000.00	0.267	0.008	11.00	1.60	9.40	0.259	15,520,000.00
14.2	2nd Floor	3,800,000.00	114,000.00	0.063	0.002	7.00	0.00	7.00	0.062	3,686,000.00
15	Wifi work									
15.1	1st Floor	146,886,800.00	2,937,736.00	2.453	0.049	95.00	8.00	87.00	2.403	143,949,064.00
15.2	2nd Floor	42,723,710.00	854,474.20	0.713	0.014	75.00	0.00	75.00	0.699	41,869,235.80
16	Fire Alarm work									
16.1	1st Floor	12,720,000.00	890,400.00	0.212	0.015	46.00	4.40	41.60	0.198	11,829,600.00
16.2	2nd Floor	9,070,000.00	634,900.00	0.151	0.011	36.00	3.40	32.60	0.141	8,435,100.00
16.3	procurement of fire estingushers	3,750,000.00	262,500.00	0.063	0.004	5.00	0.00	5.00	0.058	3,487,500.00
17	Sound work									
17.1	1st Floor	21,914,000.00	1,533,980.00	0.366	0.026	37.00	3.70	33.30	0.340	20,380,020.00
17.2	2nd Floor	5,560,000.00	389,200.00	0.093	0.006	24.00	0.00	24.00	0.086	5,170,800.00
18	Lightning work	17,301,000.00	-	0.289	0.000	83.50	0.00	83.50	0.289	17,301,000.00

Table V.11 List Work will be rescheduled

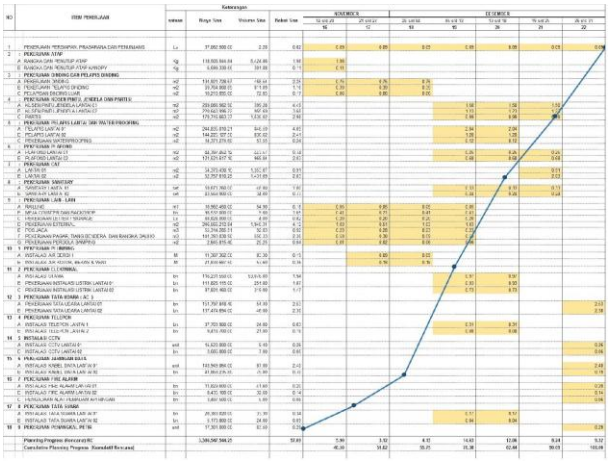


Table V.12 The Curve "S" rescheduling

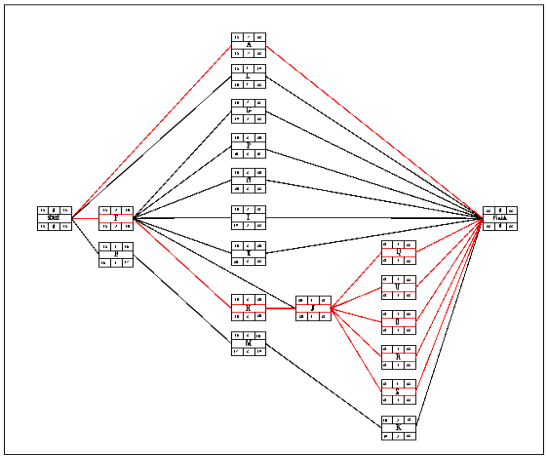


Figure V. 4 Precedence Diagram Network (PDM) for rescheduling

Recapitulation of the relationship of Table V.11, v.12 Tables and Figures V.4 can be seen in Table V.13 below:

No	Activity	Node	predecessor	Time (Week)	Cost (Rp)	
				Normal	Normal	
1	Preparation, Infrastructure and Support	A	-	7	Rp.	37,062,500.00
2	Roof Work	E	-	1	Rp.	125,105,875.38
3	Wall work and Coatings	F	-	3	Rp.	214,895,832.57
4	Door frame, windows and partitions	G	F	3	Rp.	668,474,222.49
5	Floor coating and Water Proofing	H	F	2	Rp.	403,431,412.31
6	Ceiling	I	F	3	Rp.	165,919,069.21
7	Paint work	J	F,H	1	Rp.	107,128,040.44
8	Sanitary work	K	M	3	Rp.	103,241,160.00
9	Other works	L	-	4	Rp.	604,237,794.65
10	Plumbing work	M	E	2	Rp.	33,146,050.00
11	Elektrikal work	N	F	2	Rp.	315,882,125.00
12	Air conditioner work(AC)	O	J	1	Rp.	289,272,542.40
13	Telephon work	P	F	2	Rp.	47,122,600.00
14	Installation of CCTV	Q	J	1	Rp.	19,206,000.00
15	Wifi work	R	J	1	Rp.	185,818,299.80
16	Fire Alarm work	S	J	1	Rp.	23,752,200.00
17	Sound work	T	F	2	Rp.	25,550,820.00
18	Lightning work	U	J	1	Rp.	17,301,000.00
TOTAL		-	-	7	Rp.	3,386,547,544.25

Description:

Critical Path

1.) Start + A + Finish
2.) Start + F + H + J + O + Finish
3.) Start + F + H + J + Q + Finish
4.) Start + F + H + J + R + Finish
5.) Start + F + H + J + S + Finish
6.) Start + F + H + J + U + Finish

Time Critical

1.) 0 + 7 + 0 = 7 Weeks
2) 0 + 3 + 2 + 1 + 1 + 0 = 7 Weeks
3) 0 + 3 + 2 + 1 + 1 + 0 = 7 Weeks
4) 0 + 3 + 2 + 1 + 1 + 0 = 7 Weeks
5) 0 + 3 + 2 + 1 + 1 + 0 = 7 Weeks
6) 0 + 3 + 2 + 1 + 1 + 0 = 7 Weeks

Total Cost

Rp. 3,386,547,544.25

5.4 Crashing

Crashing the project can be defined as project acceleration, acceleration is a reduction of the normal time activity obtained by providing more resources for the activities to be reduced due course.

Crashing the project can be done in various ways, among others:

a. Increase quality resources.
b. Extra time (overtime).
c. Rearrange the late schedule.

In this final project, researchers conducted the process of rescheduling the renovation project of the building BPJS Surakarta at week 15 to week 22 in getting the remaining time for 7 weeks, it is then the next process is to speed up the project (Crashing) by using some experimental alternatives acceleration, among others:

1. Accelerating the implementation time to 6 weeks

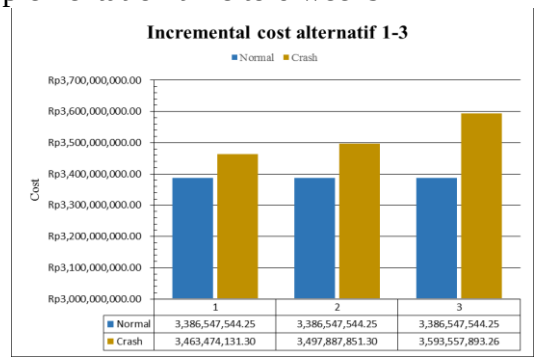


Figure V.8 Graph incremental cost alternative 1-3

From the Figure V. above, the value of incremental cost that comes with every alternate acceleration, among others:

1.) Alternative acceleration 1
=Rp. 76,926,587.05
2.) Alternative acceleration 2
=Rp. 111,340,307.05
3.) Alternative acceleration 3
=Rp. 207,010,349.01

Based on data from alternative acceleration 1 through 3 above, then alternative 1 the most efficient acceleration to be accelerated during the first weeks of implementation time.

2. Accelerating the implementation time to 5 weeks

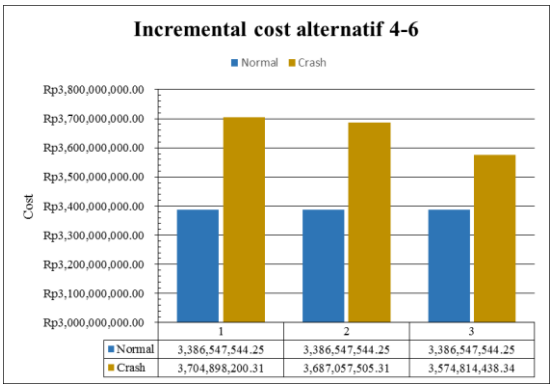


Figure V.12 Graph incremental cost alternative 4-6

From the Figure V.12 above, the value of incremental cost that comes with every alternative acceleration, among others:

1.) Alternative acceleration 4
= Rp. 318,350,656.06
2.) Alternative acceleration 5
= Rp. 300,509,961.06
3.) Alternative acceleration 6
= Rp. 188,266,894.09

Based on data from alternative acceleration 4 to 6 above, then the alternative most efficient acceleration 6 to be accelerated during the 2-week period of implementation.

3. Acceleration time of execution to 4 weeks.

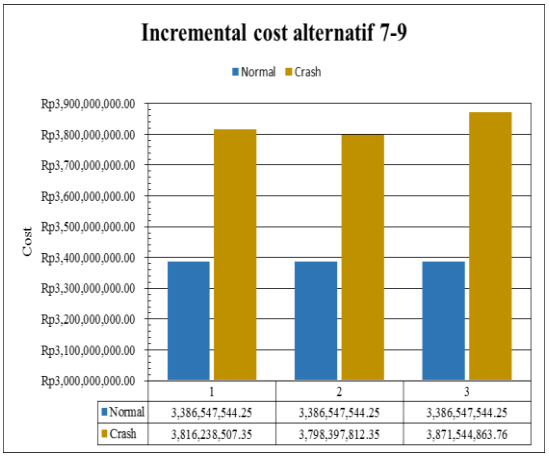


Figure V.16 Graph incremental cost alternative 7-9

From the figure V.16 above, the value of incremental cost that comes with every alternate acceleration, among others:

1.) alternative acceleration 7
= Rp. 429,690,963.10
2.) Alternative acceleration 8
= Rp. 411,850,268.10
3.) Alternative acceleration 9
= Rp. 484,997,319.51

Based on data from alternative acceleration 7 to 9 above, the alternative most efficient acceleration 8 to be accelerated during the third week implementation time.

3. Optimization of the cost and time of alternative acceleration 1-9

Normal cost incurred during the 7-week implementation time is Rp 3,386,547,544.25. Based on the above, the alternative data acceleration efficiency analysis of alternative acceleration 1-9 is as follows:

a. Based on an analysis of alternatives acceleration 1-3 with 1 week expedite execution of the work, found an alternative 1 that experienced the least incremental cost is Rp. 76,926,587.05 with a total cost of Rp. 3,463,474,131.30.
b. Based on an analysis of alternatives acceleration 4-6 with 2 weeks accelerate the execution of the work, alternative obtained the 6th experiencing the least incremental cost is Rp. 188,266,894,09 a total cost of Rp. 3,574,814,438.34.
c. Based on an analysis of alternatives acceleration 7-9 with 3 weeks accelerate the execution of the work, alternative obtained the 8th experiencing the least incremental cost is Rp. 411,850,268.10 with a total cost of Rp. 3,798,397,812.35.

Then, based on the above analysis graphed third time and cost efficiencies that can be seen in Figure V.17, the following:

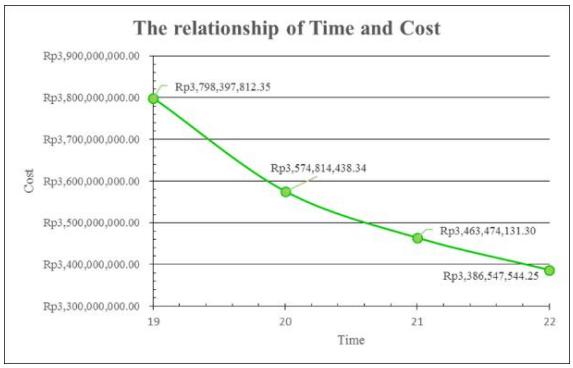


Figure V.17 Graph cost and time efficiencies

Based on the figure V.17 graph between time and cost efficiencies above shows that each carried acceleration time implementation work required then the cost increases.

Then, after the obtained values of the three alternative acceleration efficiency with different duration of acceleration for 1 week, 2 weeks, and 3 weeks of accelerated implementation, then the next step will be chosen again the most optimal alternative for the acceleration of the work done. With the following considerations:

a. Alternative 1

1.) Timing of 6 weeks.
2.) The number of critical path, there were 7 lanes.
3.) Accelerated job is a job preparation, wall work, and work wall coverings on floor 1 & 2.
4.) The total cost increase due to acceleration is Rp. 76,926,587.05.
5.) The total cost of the overall project after the acceleration for 1 week to Rp. 3,463,474,131.30.

b. Alternative 6

1.) Timing of 5 weeks.
2.) The number of critical path, there were 7 lanes
3.) Accelerated job is a job preparation, work wall, wall coating work on floors 1 and 2, and sanitary work on floors 1 and 2.
4.) The total cost increase due to acceleration is Rp. 188,266,894.09.
5.) The total cost of the overall project after the acceleration for 2 weeks to Rp. 3,574,814,438.34.

c. Alternative 8

1.) Timing of 4 weeks.
2.) The number of critical path there are 10 lanes.
3.) Accelerated job is a job preparation, work wall, wall coating work on floors 1 and 2, the work floor, water proofing work, sanitary work on floors 1 and 2, and plumbing work.
4.) The total costs increase due to acceleration to Rp. 411,850,268.10.
5.) The total cost of the overall project after the acceleration for 3 weeks to Rp. 3,798,397,812.35.

Based on the analysis of acceleration above a third alternative, the most optimal alternative in terms of both time and the total budget required is an alternative acceleration to-1, with the duration of the project implementation time for 6 weeks and a total cost of Rp. 3,463,474,131.30.

6. CONCLUSIONS AND SUGGESTION

6.1 Conclusion

1. The delay that occurs in the project building renovation of BPJS Surakarta occurred in week 15 with the progress of the implementation of the project is lower than the progress of the planned, with the weight of the implementation of 42, 60% and 43.78% weight plan. Here is the progress of project implementation:
   a. Week 1 to Week 2, project work is completed late than plan at a cost lower than the budget.
   b. Week 3 to week 14, project work done faster than planned at a cost less than the budget.
   c. Week 15 to week 22, project work is completed late than plan at a cost lower than the budget.

2. Based on the research that has been done, the cost analysis on building renovation projects BPJS in Surakarta is as follows:
   a. Week 1 to 2, lower implementation costs Rp. 10,780,635.60 of the plan costs Rp. 13,176,332.39.
   b. Week 3 to week 14, a higher implementation costs Rp. 2,374,135,527.87 of the plan costs Rp. 1,975,252,010.82.
   c. Week 15 to week 21, a lower implementation cost of Rp. 5,318,446,893.91 of the plan costs Rp. 5,752,068,014.54.
   d. Week 22, the cost of implementing the plan is equal to the cost of Rp. 5,989,241,997.65.

3. Based on rescheduling conducted by a network of Precedence Diagram Method (PDM) at week 15 to week 22 showed the following analysis:
   a. Critical Path

1.) Start + A + Finish
2.) Start + F + H + J + O + Finish
3.) Start + F + H + J + Q + Finish
4.) Start + F + H + J + R + Finish
5.) Start + F + H + J + S + Finish
6.) Start + F + H + J + U + Finish

   b. Time Critical

1.) 0 + 7 + 0 = 7 week
2) 0 + 3 + 2 + 1 + 1 + 0 = 7 week
3) 0 + 3 + 2 + 1 + 1 + 0 = 7 week
4) 0 + 3 + 2 + 1 + 1 + 0 = 7 week
5) 0 + 3 + 2 + 1 + 1 + 0 = 7 week
6) 0 + 3 + 2 + 1 + 1 + 0 = 7 week

   c. Total costs of rescheduling at week 15 to week 22 was Rp. 3,386,547,544.25.

4. Based on the results of the acceleration is done on the rescheduling obtained as alternative-1 to the most optimal alternative is to accelerate the duration of the project for 6 weeks and the total project cost of Rp. 3,463,474,131.30.

6.2 Suggestion

1.For managers of PT. Penta Electro Powerindo as building renovation project contractor BPJS and Surakarta to be more thorough understanding of project scheduling order better future.

2.For the contractor to use the method (network planning) in the scheduling for project management so that the future more clearly.

3.This study uses a network of Precedence Diagram Method (PDM) and the analysis of the curve "S", it is good to use other methods for comparison to get a result which is more complex.

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