PROJECT MANAGEMENT SYSTEM AT CV. ANAKING JIMAT AWAKING

Nori Cahyana[1], Sufa'atin. S.T.,M.Kom[2]
[1,2] Teknik Informatika – Universitas Komputer Indonesia
Jl.Dipatiukur 112-114 Bandung
E-mail : noricahyana01@gmail.com[1],sufaatin@email.unikom.ac.id[2]

ABSTRACT

CV. ANAKING JIMAT AWAKING is one company that is engaged in construction services provider among the field of construction, development, implementation of the project. In the implementation of the project is done there are the problems caused by several factors, including the scheduling of existing not specific enough because it does not show the relationship between the activity of the other activities, lack of attention to the risks - risks that can affect berjalanya project, as well as the estimation process time and cost to do the company does not show the relationship between the activities that have been achieved in the field with the costs incurred.

Based on the problems described above, it is to mitigate these problems need a method include methods Precedence Diagraming Method (PDM) as a method for project scheduling, methods Probability Impact Matrix (PIM) to analyze the probability of the emergence of risks and impacts and methods of Earned Value Management (EVM), methods of EVM is a method that facilitates the control of the project cost estimates and time.

This research resulted in the project management system that can help in scheduling the project, helping to analyze the risks that exist in the field that have a negative impact on project implementation and prepare the appropriate responses, and assist in the estimation of the cost and time of execution of the project.

Kata kunci : Sistem Manajemen Proyek, Earned Value Management, Precedence Diagraming Method, Probability Impact Matrix.

1. INTRODUCTION

CV. ANAKING JIMAT AWAKING is one company that is engaged in construction services provider among the field of construction, development, implementation of the project. Based on the interview with Mr. Dadang Supriyadi as a director or person in charge of the project, in the implementation of projects undertaken CV. ANAKING JIMAT AWAKING there are problems caused by several factors, including the scheduling of existing not specific enough because it does not show the relationship between the activity of the other activities, so that if there is a delay in one activity, the impact on the overall activities of the project can not diketehui quickly it causes control will take some time, the impact the project completion schedule and costs will rise so that the company suffered losses. Lack of attention to the risks - risks that may affect project berjalannya resulting in increased project completion schedule and the cost will increase because they have to cope with those risks. The estimation process time and costs by the company does not show the relationship between the activities that have been achieved in the field with the costs incurred so it is unknown whether the charge is issued in accordance with the work that has been achieved in the field. Besides the progress reported by the executor in the field sometimes experienced delays because of the distance office to the project site far enough. Of the existing problems resulted in the company's profits decreased or no benefit, other than that the company gets a penalty from the project owner for the project was completed more than a predetermined time earlier, the company name will not be good in the eyes of the owner of the project and will not even be invited in auction next project.

Based on the problems faced by CV. ANAKING JIMAT AWAKING, it needed a project management system that can help in the scheduling process, helps analyze the probability of the emergence of risks and determine ways to overcome them, and assist in the estimation of the time and cost of the project. The methods used in the construction of the project management system in CV. ANAKING JIMAT AWAKING is a method of Precedence Diagraming Method (PDM) as a method for project scheduling, methods Probability Impact Matrix (PIM) to analyze the probability of the emergence of risks and impacts and methods of Earned Value Management (EVM), the method of EVM is a method that facilitates the estimation of costs and project time. It is expected with this system done project CV. ANAKING JIMAT AWAKING not experience delays.

2. CONTENTS OF RESEARCH

2.1 Analysis Project Planning

Analysis of project design contains scheduling analysis and risk analysis on the Road Improvement project undertaken by CV. TALISMAN ANAKING

AWAKING. In this case the project scheduling methods Precedence Diagramming Method (PDM) and risk management using Probability Impact Matrix (PIM).

2.1.1 Precedence Diagramming Method (PDM)

Precedence Diagramming method (PDM) is one of scheduling techniques are included in the planning or scheduling techniques networking networks plan focused activities PDM node so sometimes referred to as activity on nonde (AON). The following data Roads Improvement project activities can be seen in the table below.

Tabel 1. Road Improvement Work Activities

Uraian Pekerjaan	Kode Kegiatan	Kegiatan Pendahulu	Durasi
1. Pekerjaan Persiapan			
Pek. Pemb. Gudang bahan	I.1	-	7 day
Pek. Pengukuran	I.2	-	7 day
Pek. Pemb. Papan Nama Proyek	I.3	-	7 day
Pek. *Quality Control*	I.4	-	7 day
Pek. As. Builtdrawing	I.5	I.1, I.2, I.3, I.4	5 day
2. Pekerjaan Jalan Rigid			
Pek. Pembongkaran Beton (Oprit)	II.1	I.1, I.2, I.3, I.4	7 day
Pek. Galian Batu (oprit)	II.2	I.2 , II.1	7 day
Pek. Lapis Pondasi Bawah (batu belah)	II.3	II.2	7 day
Pek. Lapis Pondasi Agregat Keles C (sirtu)	II.4	II.3	21 day
Pek. Baja Tulangan U24 Polos	II.5	II.3	14 day
Pek. Beton K125 Ready Mix tb. 5cm	II.6	II.4, II.5	14 day
Pek. Pekerasan Jalan Beton K.350	II.7	II.6	14 day
Pek. Lapis Pondasi gregat Keles C (sirtu)	II.8	II.9	14 day
Pek. Perendam (curing)	II.9	II.7	28 day
3. Pekerjaan Oprit Jalan Rigid			
Pek. Lapis Pondasi Bawah (batu belah)	III.1	II.9	3 day
Pek. Lapis Pondasi Agregat Kelas C	III.2	III.1	3 day
Pek. Pemberesan	III.3	II.8 , III.2	1 day

Based on a series of activities in the Road Improvement project in Table 1, illustrated in diagram form of network planning by using the resulting AON medel like Figure 1.

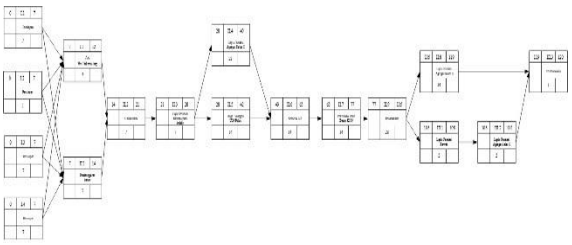


Figure 1. PDM Network

Calculations to determine the time of completion in the PDM method consists of two phases, namely a forward direction (forward pass) and perhitungn backward direction (backward pass). Here's an explanation of the stages:

1. Calculation of forward (forward pass) on activities / node to find the value of ES and EF.

   Activity I.1
   $ES_{(I.1)} = 0$
   $D_{(I.1)} = 7$
   $EF_{(I.1)} = (ES_{(I.1)} + D_{(I.1)}) = 7$

2. Calculation of the forward direction (backward pass) on activities / node for value SL, LS and LF.

   Actuvity I.1
   $SL_{(I.1)} = ES_{(I.5)} – EF_{(I.1)}= 7 – 7 = 0$
   $LS_{(I.1)} = SL_{(I.1)} + ES_{(I.1)} = 0 + 0 = 0$
   $LF_{(I.1)} = LS_{(I.1)} + D_{(I.1)} = 0 + 7 = 7$

   $SL_{(I.1)} = ES_{(II.1)} – EF_{(I.1)}= 7 – 7 = 0$
   $LS_{(I.1)} = SL_{(I.1)} + ES_{(I.1)} = 0 + 0 = 0$
   $LF_{(I.1)} = LS_{(I.1)} + D_{(I.1)} = 0 + 7 = 7$

Based on the above calculation can be seen the value of the ES, EF, SL, LS and LF, the final result of all the work on the project activity Road Improvement can be seen from Table 2.

Tabel 2. *Recapitulation Calculation*

No	Kode	Durasi	ES	EF	SL	LS	LF
1	I.1	7	0	7	0	0	7
2	I.2	5	7	12	2	9	14
3	II.1	7	7	14	0	7	14
4	II.2	7	14	21	0	14	21
5	II.3	7	21	28	0	21	28
6	II.4	21	28	49	0	28	49
7	II.5	14	28	42	7	35	49
8	II.6	14	49	63	0	49	63
9	II.7	14	77	105	0	77	105
10	II.8	14	105	119	0	105	119
11	II.9	28	77	105	0	77	105
12	III.1	3	105	108	0	105	108
13	III.2	3	105	111	8	116	119
14	III.3	1	119	120	0	119	120

Based on Table 2 obtained keritis path of PDM calculation. Hiking keritis is the path by job keritis ie jobs that have the earliest start time is equal to the start time of the end (ES = LS) and end time for the earliest at the end time for the last (EF = LF) can be seen in Figure 2.

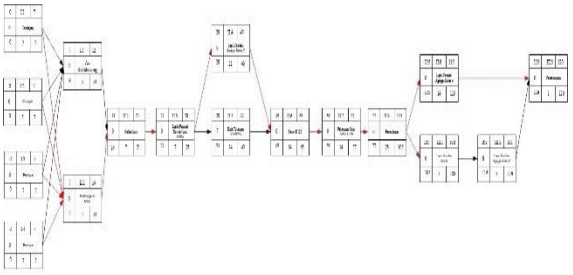


Figure 2. Jalur Keritis PDM

From Figure 2 it can be concluded that the path I.1, I.2, I.3, I.4, II.2, II.3, II.4, II.6, II.7, II.9, II.8 , III.3 is the path keritis then work through these pathways should not be any delay.

2.1.2 Manajemen Resiko

The risk management process has several stages of identifying risks, determining the value of the likelihood and impact of risk as well as the handling of these risks.

2.1.2.1 Identifikasi Resiko

Risk management process begins with the identification of risks that aims to identify and make a list of possible risks. This event identification process carried out by the method of brainstorming or discussion approach and interviews with the company.

Table 3. Variable Project Risks

No	Resiko	Kode Resiko
1	Land contours are difficult to predict	R1
2	The weather is currently difficult to predict	R2
3	Delay materials	R3
4	Materials not within specifications	R4
5	The loss of material goods	R5
6	Material damage in shipping	R6
7	Work accident	R7
8	Trustees are slowly checking	R8
9	Impairment of project tools	R9

2.1.2.2 Menentukan Nilai Kemungkinan dan Dampak Resiko

After the stage of identification of risks that might occur in Pabuaran Pringkasap Road Improvement project, then the risk will be assessed to provide the scale value using a rectangular matrix of boston (Boston Square Matrix). The following matrix can boston diihat quadrilateral in figure 3.



Figure 3. Boston Square Matrix

Boston matrix based on the assessment of any risk opportunity and the impact made on the scale is from 1 to 25 as described in Table 4.

Tabel 4. Level Resiko

No	Skala	Level Resiko
1	1 – 5	Low
2	6 – 14	Medium
3	15 – 25	High

Criteria for assessment of the impact (impact factor) and measurement chance (probability) in accordance with Australian / New Zealand Risk Management of the Standard [1] shown in tables 5 and 6 below.

Table 5. *Impact Assessment Criteria*

No	Rating	Value	Impact
1	Slight	1	No significant impact is felt, the financial loss does not mean
2	Minor	2	Need direct handling in place, the financial losses into the cost of additional expenditure (over head)
3	significant	3	Need to be addressed by implementing, significant financial loss
4	Severe	4	A delay in the planned schedule.
5	Mayor	5	Need handling by the director, a huge loss, need special handling

Tabel 6. Measurement Probability

No	Rating	Value	Probability
1	very unlikely	1	Rarely, only on certain conditions
2	Unlikely	2	Sometimes occurs in certain conditions
3	Possible	3	Dapat terjadi pada kondisi tertentu
4	Likely	4	Can occur in certain circumstances
5	very likely	5	Often occurs in certain conditions

Value likelihood and impact of risk resulting in project implementation based on the Road Improvement Table 5 and Table 6 can be seen in Table 7.

Table 7. Possible Values Analysis Results and Impact

No	Risk	Risk	Probability	Impact
1	Land contours are difficult to predict	R1	2	2
2	The weather is currently difficult to predict	R2	4	4
3	Delay materials	R3	4	4
4	Materials not	R4	2	3

	within specifications			
5	The loss of material goods	R5	2	2
6	Material damage in shipping	R6	2	2
7	Work accident	R7	2	3
8	Trustees are slowly checking	R8	2	2
9	Impairment of project tools	R9	3	3

2.1.2.3 Specifies Interest Rate Risk

After determining the value of the probability and impact of risk, then calculating the interest rate risk using methods Probability Inpact and Matrix. The level of interest risk is calculated using the formula Risk Exposure.

Risk Exposure = probability (outcome) * Loss (outcome)

Ket :

a. *Risk Exposure* = Importance Risk
b. *Probability* (*outcome*) = Risk Probability Value
c. Loss (outcome) = Value Impact Generated

Here are the results of calculation of interest rate risk can be seen in Table 8.

Table 8. Interest rate Risk Calculation Results

No	Risk Kode	Probability	Impact	Importance Risk
1	R1	2	2	4
2	R2	4	4	16
3	R3	4	4	16
4	R4	2	3	12
5	R5	2	2	4
6	R6	2	2	4
7	R7	2	3	6
8	R8	2	2	4
9	R9	3	3	9

Based on the results of the calculation of the interest rate risk of the above are grouped by category Resko Boston Square Matrix in Figure 3 The following categories of risk level in table 9.

Tabel 9. Category Level Risk

No	Resiko	Kode Resiko	Tingkat Kepentingan	Level Resiko
1	Land contours are difficult to predict	R1	4	Rendah
2	The weather is currently difficult to predict	R2	16	Tinggi
3	Delay materials	R3	16	Tinggi
4	Materials not	R4	12	Sedang

	within specifications			
5	The loss of material goods	R5	4	Rendah
6	Material damage in shipping	R6	4	Rendah
7	Work accident	R7	6	Sedang
8	Trustees are slowly checking	R8	4	Rendah
9	Impairment of project tools	R9	9	Sedang

Pursuant to the results of the determination of the level of risk above, found four risk at low levels, namely R1, R5, R6, R8, then 3 risk level of being, namely R4, R7, R9, and two risk levels as high as R2, R3, the risk of R2 and R3 must get attention because it will have a major impact on the project keberlangsugan.

2.2 Analysis Project Control

Analysis pengndalian project contains analysis of budget evaluation Roads Improvement project undertaken by CV. TALISMAN ANAKING awaking. In this case the evaluation analysis project using Earned Value Management (EVM).

2.2.1 Analysis of Project Evaluation

Value method results or Earned Value Method, a method that can provide information about the position of the progress of the project within a certain period and can predict the progress of the project in the next period, namely in terms of costs and project completion time [3]. There are three indicators in the assessment of the results of Nili method is as follows:

1. BCWS (*Budgeted Cost of Work Schedule*) atau *Planned Value* (PV).
2. BCWP (*Budgeted Cost of Work Performed*) atau *Earned Value* (EV).
3. ACWP (*Actual Cost of Work Performed*) atau *Actual Cost* (AC).

2.2.1.1 Calculation of Planned Value (PV)

PV also called Budgeted Cost of Work Schedule (BCWS) is budgeted cost for the work scheduled in a given period and is set in the budget. Obtained by multiplying the percentage of progress plans with total project budget Budget At Completion (BAC).

Calculation PV the first week :

BAC = Rp. 815.816.879,10

Weights (progress plan) = 0,82 %

PV = (% Progress plan) X BAC

= 0,82 % x 815.816.879,10

= 6.650.000

Table 10. Analysis Calculation of Planned Value (PV)

No	Week	Weight (%)	PV	
			Weekly	Cumulative
1	Week -1	0,82	Rp. 6.650.000,00	Rp. 6.650.000
2	Week -2	0,18	Rp. 1.481.910,95	Rp. 8.131.910,95
3	Week -3	0,14	Rp. 1.158.541,45	Rp. 9.290.452,4

2.2.1.2 Calculation of Earned Value (EV)

EV also called Budgeted of Work Performed (BCWP) is the sum of the costs incurred in accordance with the work accomplished in the field. EV is derived by multiplying the percentage of progress that has been implemented with a total budget of the project Budget At Completion (BAC).

EV calculation in week 1 :

BAC = Rp. 815.816.879,10

Progres = 0,82 %

EV = (% Actual progress) x BAC

= 0,82 % x Rp. 815.816.879,10

= Rp. 6.650.000

Table 11. Analysis Calculation of Earned Value (EV)

No	Week	Weight (%)	EV	
			Weekly	Cumulative
1	Week-1	0,82 %	Rp. 6.650.000,00	Rp. 6.650.000,00
2	Week-2	0,18 %	Rp. 1.481.910,95	Rp. 8.131.910,95
3	Week-3	0,14 %	Rp. 1.158.541,45	Rp. 9.290.452,40

2.2.1.3 Analysis Calculation of Actual Cost (AC)

Analysis of Actual Cost is the amount of the actual cost of the work that has been carried out. AC value obtained based on the expenses of the work that has been carried out.

Here is the Actual Cost of Road Improvement project Pabuaran - Pringkasap can be seen in Table 12.

Table 12. Analysis Calculation of Actual Cost (AC)

No	Week	AC	
		Weekly	Cumulative
1	Week-1	Rp 6.570.000	Rp 6.570.000
2	Week-2	Rp 1.360.000	Rp 7.930.000
3	Week-3	Rp 1.100.500	Rp 9.030.500

2.2.1.4 Varian Analysis Calculation

Variant Analysis is done by finding the value of Cost Variance (CV) and the Schedule Variance (SV). CV calculation derived from EV reduced AC, was obtained from the SV EV reduced PV.

According to the table 11 Analysis Calculation of Earned Value (EV) and Table 12 Analysis Calculation of Actual Cost (AC) obtained CV value calculation as follows:

CV calculations in week 1 :

EV = Rp. 6.650.000,00

AC = Rp. 6.570.000,00

CV = EV – AC

= 6.650.000,00 - 6.570.000,00

= 80.000

Table 13. Analysis Calculation of Cost Variance (CV)

No	Week	EV	AC	CV = EV – AC
1	Week-1	Rp. 6.650.000,0	Rp 6.570.000	Rp.80.000,00
2	Week-2	Rp. 8.131.910,95	Rp 7.930.000	Rp.201.910,95
3	Week-3	Rp. 9.290.452,40	Rp 9.030.500	Rp.259.952,40

Based on table 13, the obtained value of CV> 0 in the period from week 1 to week 3 is positive, it shows that the work completed at a cost lower than planned.

According to the table 11 Analysis Calculation of Earned Value (EV) and table 10 Analysis Calculation of Planned Value (PV) SV value calculation obtained as follows :

SV calculation at week 1 :

EV = Rp. 6.650.000,00

PV = Rp. 6.650.000,00

SV = EV – PV

= 6.650.000 - 6.650.000

= 0

Table 14. Analysis Calculation Schedule Variance (SV)

No	Week	EV	PV	SV = EV – PV
1	Week-1	Rp. 6.650.000	Rp. 6.650.000	0,00
2	Week-2	Rp. 8.131.910,95	Rp. 8.131.910,95	0,00
3	Week-3	Rp. 9.290.452,4	Rp. 9.290.452,4	0,00

Based on table 14, got value SV = 0 in the period from week 1 to week 3 is 0, indicating that the job can be completed according to the schedule planned.

2.2.1.5 Perhitungan Analisis Indeks Kinerja

Analysis of the performance index is done by finding the value of the Schedule Performance Index (SPI) and the Cost Performance Index (CPI). SPI calculation derived from a comparison between EV with PV, while the CPI is derived from the ratio of the EV to the AC.

According to the table 11 Analysis Calculation of Earned Value (EV) and 10 Analysis Calculation of Planned Value (PV) obtained SPI value calculation as follows:

The calculation of the SPI at week 1:

EV = Rp. 6.650.000,00

PV = Rp. 6.650.000,00

SV = EV /PV

= 6.650.000 /6.650.000

= 1

For the calculation of the SPI next week can be seen in Table 15.

Table 15. Analysis Calculation Schedule Performance Index (SPI)

No	Week	EV	PV	SPI = EV/PV
1	Week 1	Rp. 6.650.000	Rp. 6.650.000	1
2	Week 2	Rp. 8.131.910,95	Rp. 8.131.910,95	1
3	Week 3	Rp. 9.290.452,4	Rp. 9.290.452,4	1

Based on table 15, the value of SPI in week one to week three grades SPI = 1, this shows that the project is being carried out in accordance with the planned schedule.

According to the table 11 Analysis Calculation of Earned Value (EV) and 12 Analysis Calculation of Actual Cost (AC) obtained the calculation of CPI as follows:

CPI calculation Week 1 :

EV = Rp. 6.650.000

AC = Rp. 6.570.000

CPI = EV/AC

= 6.650.000/6.570.000

= 1,01

For the calculation of CPI next week can be seen in Table 16.

Table 16. Analysis Calculation of Cost Performance Index (CPI)

No	Week	EV	AC	CPI = EV / AC
1	Week - 1	Rp. 6.650.000	Rp 6.570.000	1,01
2	Week - 2	Rp. 8.131.910,95	Rp 7.930.000	1,03
3	Week - 3	Rp. 9.290.452,4	Rp 9.030.500	1,03

Based on table 16, the value obtained in the calculation period weekly CPI CPI> 1.00, indicating that the job is done with a smaller cost than planned.

2.2.1.6 Calculation Analysis and Cost Estimation Completion Time

Analysis of the cost and time estimates done by looking for cost estimation or Estimate At Completion (EAC) and the estimated duration of the project completion or Estimate To Complete (ETC).

AC obtained from tables 12 Analysis Calculation of Actual Cost (AC) obtained calculation Estimate At Completion (EAC) as follows:

Calculation EAC week 1 :

AC = Rp. 6.570.000,00

BAC = Rp. 815.816.879,10

EV = Rp. 6.650.000

SPI = 1

CPI = 1,01

EAC = AC + ((BAC – EV)/(CPI x SPI)

= 6.570.000,00 + ((815.816.879,10 - 6.650.000)/(1,01 x 1))

= Rp.806002540,7

For the calculation of EAC next week can be seen in Table 17.

Table 17. Analysis Calculation Estimate at Completion (EAC)

No	Week	EV	BAC	AC	CPI	SPI	EAC
1	Week 1	6.650.000	815.816.879,10	6.570.000	1,01	1	806.002.540,7
2	Week 2	8.131.910,95	815.816.879,10	7.930.000	1,03	1	795.560.587,3
3	Week 3	9.290.452,4	815.816.879,10	9.030.500	1,03	1	792.989.836,2

In Table 17 shows the estimated costs to complete the project based on the costs that have been issued in every activity.

According to the table 15 Analysis Calculation Schedule Performance Index (SPI) gained ETC calculation as follows:

Calculation of ETC week 1

OD (*original duration*) = 120 hari

SPI = 1

ETC = OD / SPI

=120/1

= 120 hari

For the calculation of ETC next week can be seen in Table 18.

Table 18. Analysis Calculation Estimate To Completion (ETC)

No	Week	OD	SPI	ETC = OD / SPI
1	Week-1	120	1	120
2	Week -2	120	1	120
3	Week -3	120	1	120

Based on the analysis of variance, the performance index, and obtained estimates of the recapitulation of the analysis are shown in Table 19.

Table 19. Recapitulation Analysis Earned Value Method (EVM)

Week	Analisis Varian		Analisis Kinerja		Analisis Estimasi	
	Time SV (Rp)	Cost CV (Rp)	Time SPI (Rp)	Cost CPI (Rp)	Time ETC (hari)	Cost EAC (Rp)
Week -1	0,00	Rp.80.000,00	1	1,01	120	806002 540,70
Week -2	0,00	Rp.201.910,95	1	1,03	120	795560 587,30
Week -3	0,00	Rp.259.952,40	1	1,03	120	792989 836,18

Recapitulation of project performance using EVM in Table 19 above it was concluded that the project Improvement of road that has been done according to plan and estimate of costs is smaller than the budget plan that had been planned in advance, then the project activities that have been running for 3 weeks still in good condition and in accordance with the previous plan.

3. CLOSING

3.1 Conclusion

Based on the results of research and research results and the results of testing that was done on the Project Management System at CV. Anaking Amulet On awaking, it can be deduced as follows:

Based on the description of the background issues that have been described, the problems to be studied in this research are:

1. The project management system that is built can help project managers in scheduling so as to know the relationship between the work and determine how much influence the delay in the work on the entire project.
2. Project management system that is built can help project managers analyze pelung emergence of risks and determine its response.
3. Project management system that is built can help project managers to estimate the cost and time of execution of the project, and determine compatibility between the costs incurred by the work that has been accomplished.
4. Project management system that is built to help implementers in the field, where progress report on time.

3.2 Suggestion

Based on the results of testing the system, there are suggestions that can be done to add things that can complement the project management system in the future, among other things:

1. Project management system is equipped with the calculation of the acceleration of the project.
2. Project management system is equipped with the financial management of the overall project.
3. Project management system is equipped with features resource management.

BIBLIOGRAPHY

[1] *Australian/New Zealand Standard Risk Management*, Australia: Council of Standard Australia/New Zealand, 1999.

[2] Kasidi. *Manajemen Risiko*. Bogor: Ghalia, 2014.

[3] I. Soeharto, Manajemen Proyek (Dari Konseptual Sampai Operasional) , Erlangga, 1999.

[4] T. T. Imam Heryanto, Manajemen Proyek Berbasis Teknologi Informasi Revisi Kedua, Bandung: Informatika, 2016.

[5] W. Ir. Irika and M. Lenggogeni, Manajemen Konstruksi, Bandung: PT. Remaja Rosdakarya, 2013