

# Analysis Scheduling XYZ Project using Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) at PT. NOV Profab

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Abstract: This study aims to test the scheduling of the XYZ project at PT. NOV Profab uses CPM and PERT methods. From this research, we will get the estimation of scheduling time and find the critical path of each method. This study uses data collection techniques by means of direct interviews with the project engineer and documentation data in the form of project schedule attachments. This study was structured with mixed methods. Each method has 3 critical paths, the result of scheduling the CPM method for 52 days, according to the real schedule of the XYZ project and the PERT method for 51 days, faster with the real schedule of the XYZ project.

## 1 INTRODUCTION

### 1.1 Research Background

In this study, the object under study is the XYZ project. It is known that the XYZ project is a piping type project. The method used for scheduling a project is to use the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). The CPM method is a method that has 2 stages (two passes) in its calculation, namely forward calculation and backward calculation. According to Nurjaman (2014) PERT method is a project scheduling method that has three estimates of time for each activity, with these three times the probability of completing a project can be known.

In this study, the researcher wants to analyze the XYZ project if it is scheduled using the CPM and PERT methods which will later be known how long an XYZ project can be carried out and get the critical path. Researchers want to research related to project scheduling because the place of research is carried out in a fabrication construction company where the production process is producing projects and each project has its own schedule, and the XYZ project is the object of this research. This research was conducted using two methods, namely CPM and PERT, where the method is a project scheduling method and can find out the comparison of project

scheduling time with each method so that the final results of the research are more complex when using two methods, namely CPM and PERT.

From the results of CPM and PERT can find out how long a project can be completed and get the critical path. From the description above, the researcher will analyze and take the research title "Analysis of XYZ Project Scheduling Using Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) at PT. NOV Profab

## 2 LITERATURE REVIEW

### 2.1 Scheduling

According to Husen (2009), scheduling is the process of placing time in carrying out the stages of working on a project until it is completed by estimating existing limitations for optimal results. According to Ginting (2009), scheduling has a goal, namely, increasing the use of resources and reducing waiting times, so that work can be reduced and productivity increases, reducing delays in work that have deadlines, assisting in making decisions about the required capacity plan to avoid additional costs.

## 2.2 Project Management

Project management is the application of knowledge, skills, tools and techniques used to fulfill project activities (K.H., 2013). In the book A Guide to The Project Management of Knowledge, by Rose (2013) there are five stages or processes, that's Initiating, Planning, Executing, Monitoring and controlling, Closing

## 2.3 Networking

According to Muhardi (2011), network planning is a project plan and control, which describes the dependencies between each job described in the Network diagram. Network symbols:

Table 1: Symbol Networking.

No	Simbol	Keterangan
1.	→	Arrows mean that an activity has duration and resources
2.	○	Circle (node) is a symbol that states activities (events).
3.	→	The thick arrow (double arrow) means that the activity is a critical path.
4.	- - - - ->	The dotted arrow line (Dummy) is a symbol of pseudo activity. Pseudo activities are activities that do not require a certain duration and resources.

## 3 METHODOLOGY

### 3.1 A Research Framework

The framework of thought in this research is a theoretical concept that explains the relationship between variables. However, in this study there is only one variable, namely project scheduling. Therefore, the framework of thought in this research is as follows:

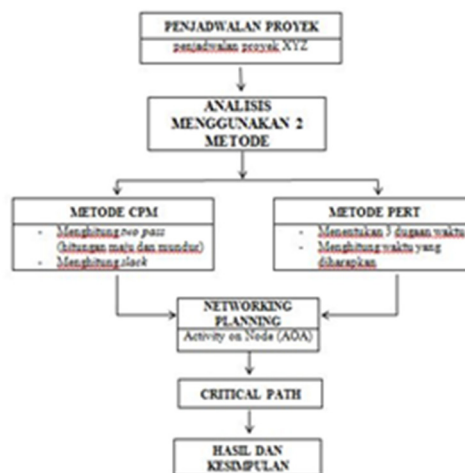


Figure 1: A Research Framework.

### 3.2 Population and Sampling Methods

The population used is in the form of data related to scheduling the XYZ project in 2021 and interview data obtained from interviews with the project engineer department, especially with the Senior Project Engineer. The population used is in the form of data related to scheduling the XYZ project in 2021 and interview data obtained from interviews with the project engineer department, especially with the Senior Project Engineer.

### 3.3 CPM Method

#### 1. Forward Pass

ES (early start) is obtained from the EF results in the previous activity.

Formula 1: Early Finish.

$$EF = ES + Duration$$

(Source: Stevenson, 2009)

#### 2. Backward Pass

To determine the LF (latest finish) with the smallest LS in the previous activity.

Formula 2: Latest Start.

$$LS = LF - Duration$$

(Source: Stevenson, 2009)

### 3. Slack

Slack value to find the critical path if the slack value = 0

Formula 3: Slack.

$$\text{Slack} : \text{LF-EF atau LS-ES}$$

(Source: Stevenson, 2009)

### 3.4 Pert Method

#### 1. Optimistic Time (a)

Optimistic time is the estimated time if a schedule does not experience constraints and the execution is as expected.

Formula 4: Optimistic Time.

$$t_a = \frac{t_a(A) + t_a(B)}{2}$$

(Source: Nurhayati, 2010)

#### 2. Pessimistic Time (b)

Pessimistic time is the estimated time if a schedule has problems and the process can take longer.

Formula 5: Pessimistic Time.

$$t_b = \frac{t_b(A) + t_b(B)}{2}$$

(Source: Nurhayati, 2010)

#### 3. Realistic/ most likely (m)

Realistic time is when it actually happens.

Formula 6: Realistic/Most Likely Time.

$$t_m = \frac{t_m(A) + t_m(B)}{2}$$

(Source: Nurhayati, 2010)

#### 4. Expected Time Activity (te)

Expected Time Activity is the expected time for scheduling to be completed by calculating 3 time estimates.

Formula 7: Expected Activity Time

$$t_e = \frac{a + 4m + b}{6}$$

(Source: Nurhayati, 2010)

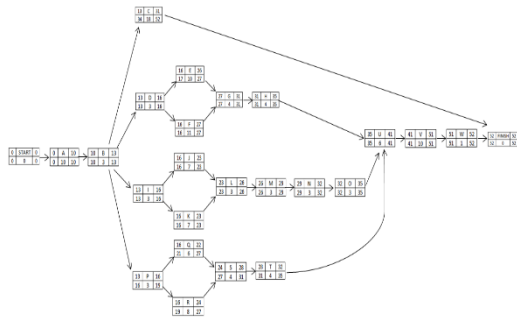
## 4 ANALYSIS AND RESULT

### 4.1 Schedule Xyz Project

Table 3: Schedule XYZ Project.

NO	ACTIVITIES	DURATION (Days)	CODE	PREDECESSOR
<b>SHOP SPOOLS FABRICATION</b>		52		
<b>ENGINEERING</b>				
1.	Document Submission	10	A	-
2.	Approval Documents	3	B	A
<b>PROCUREMENT</b>				
3.	Supply Material	18	C	B
<b>CONSTRUCTION</b>				
<b>Fabricate of Pipe Spools (4505 Inch)</b>				
<b>A1 &amp; A3 Pipe Specs (1565 Inch)</b>				
4.	Marking and Cutting	3	D	B
5.	Fit Up	10	E	D
6.	Welding	11	F	D
7.	NDT	4	G	E,F
8.	Painting	4	H	G
<b>L1 &amp; L3 Pipe Specs (3000 Inch)</b>				
9.	Marking and Cutting	3	I	B
10.	Fit Up	7	J	I
11.	Welding	7	K	I
12.	NDT	3	L	J,K
13.	Hydrating	3	M	L
14.	Painting	3	N	M
15.	Instal Rubber	3	O	N
<b>Fabricate Pipe Support</b>				
16.	Marking and Cutting	3	P	B
17.	Fit Up	6	Q	P
18.	Welding	8	R	P
19.	NDT	4	S	Q,R
20.	Painting	4	T	S
<b>Packing and Preservation</b>				
21.	Final Inspection	6	U	H,O,T
22.	Packing	10	V	U
23.	Shipment	1	W	V

### 4.2 Networking and Results CPM Method



Picture 2: CPM Networking.

Table 4: Counting CPM Method.

NO	ACTIVITIES	DURATION (Days)	CODE	ES	EF	LS	LF	SLACK (LF-EF)
1.	Document Submission	10	A	0	10	0	10	0
2.	Approval Documents	3	B	10	13	10	13	0
3.	Supply Material	18	C	13	31	34	52	21
4.	Marking and Cutting	3	D	13	16	13	16	0
5.	Fit Up	10	E	16	26	17	27	1
6.	Welding	11	F	16	27	16	27	0
7.	NDT	4	G	27	31	27	31	0
8.	Painting	4	H	31	35	31	35	0
9.	Marking and Cutting	3	I	13	16	13	16	0
10.	Fit Up	7	J	16	23	16	23	0
11.	Welding	7	K	16	23	16	23	0
12.	NDT	3	L	23	26	23	26	0
13.	Hydrating	3	M	26	29	26	29	0
14.	Painting	3	N	29	32	29	32	0
15.	Instal Rubber	3	O	32	35	32	35	0
16.	Marking and Cutting	3	P	13	16	16	19	3
17.	Fit Up	6	Q	16	22	21	27	5
18.	Welding	8	R	16	24	19	27	3
19.	NDT	4	S	24	28	27	31	3
20.	Painting	4	T	28	32	31	35	3
21.	Final Inspection	6	U	35	41	35	41	0
22.	Packing	10	V	41	51	41	51	0
23.	Shipment	1	W	51	52	51	52	0

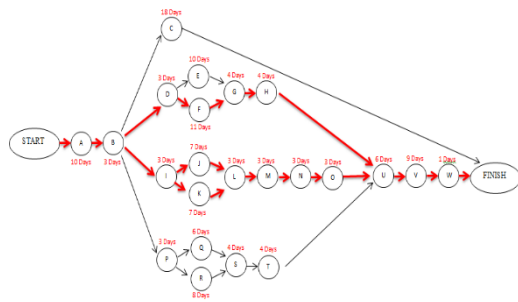
Based on the results of the research that has been done regarding the scheduling of the XYZ project using the CPM method, the results obtained for 52 days which means that the scheduling of the XYZ project using the CPM method is the same as the real time schedule

of the XYZ project. The critical path in the CPM method is the Slack value = 0. There are 3 critical paths or the longest path, namely the first path, Start-A-B-D-F-G-H-U-V-W-Finish; second line, Start-A-B-I-J-L-M-N-O-U-V-W-Finish; and the third track, Start-A-B-I-K-L-M-N-O-U-V-W-Finish.

### 4.3 Networking and Results PERT Method

Table 5: Counting PERT Method.

NO	ACTIVITIES	CODE	ta	tb	tm	te= (ta+4tm+tb):6	hasil pembulatan
1.	Document Submission	A	9	10	10	9,83	10
2.	Approval Documents	B	3	4	3	3,16	3
3.	Supply Material	C	17	21	18	18,3	18
4.	Marking and Cutting	D	3	4	3	3,16	3
5.	Fit Up	E	9	11	10	10	10
6.	Welding	F	8	11	11	10,5	11
7.	NDT	G	3	6	4	4,16	4
8.	Painting	H	4	6	4	4,3	4
9.	Marking and Cutting	I	3	4	3	3,16	3
10.	Fit Up	J	6	7	7	6,83	7
11.	Welding	K	6	8	7	7	7
12.	NDT	L	2	4	3	3	3
13.	Hydrating	M	3	4	3	3,16	3
14.	Painting	N	3	3	3	3	3
15.	Instal Rubber	O	2	4	3	3	3
16.	Marking and Cutting	P	3	4	3	3,16	3
17.	Fit Up	Q	5	7	6	6	6
18.	Welding	R	8	10	8	8,3	8
19.	NDT	S	4	5	4	4,16	4
20.	Painting	T	4	4	4	4	4
21.	Final Inspection	U	4	6	6	5,6	6
22.	Packing	V	6	10	10	9,3	9
23.	Shipment	W	1	2	1	1,16	1



Picture 3: PERT Networking.

Based on the results of research that has been done related to scheduling the XYZ project using the PERT method, taking into account 3 estimated times, the results are 51 days, which means that the scheduling of the XYZ project using the PERT method is 1 day faster than the real time schedule for the XYZ project. and there are 3 critical paths, namely the first path, Start-A-B-D-F-G-H-U-V-W-Finish; second line, Start-A-B-I-J-L-M-N-O-U-V-W-Finish; and the third line, Start-A-B-I-K-L-M-N-O-U-V-W-Finish

## 5 CONCLUSIONS

Based on the results of the study it can be concluded:

1. The results of the calculation of the XYZ project scheduling using the CPM method with a duration of 52 days, which means that the scheduling is in accordance with the real schedule of the XYZ project for 52 days. And scheduling using the PERT method was obtained for 51 days, which means 1 day faster than the real schedule of the XYZ project.
2. In the scheduling network using the CPM method, there are 3 critical paths and each has a duration of 52 days, namely path 1, Start-A-B-D-F-G-H-U-V-W-Finish; lane 2, Start-A-B-I-J-L-M-N-O-U-V-W-Finish; lane 3, Start-A-B-I-K-L-M-N-O-U-V-W-Finish. In the network using the PERT method, there are 3 critical paths for 51 days, namely lane 1, Start-A-B-D-F-G-H-U-V-W-Finish; lane 2, Start-A-B-I-J-L-M-N-O-U-V-W-Finish; lane 3, Start-A-B-I-K-L-M-N-O-U-V-W-Finish.

## REFERENCES

- Ginting , R. (2009 ). *Penjadwalan Mesin* . Yogyakarta : Graha Ilmu .

- Husen , A. (2009). *Manajemen Proyek(Perencanaan Penjadwalan dan Pengendalian Proyek)*. Yogyakarta : Andi .
- K.H., R. (2013). *A Guide to the Project Management Body of Knowledge (PMBOK Guide) Fifth Edition*. Pennsylvania: Project Management Institute.
- Muhardi. (2011). *Manajemen Operasi* . Bandung : Refika Aditama .
- Nurhyati. (2010). *Manajemen Proyek* . Jogjakarta: Graha Ilmu .
- Nurjaman kadar, D. H. (2014). *Manajemen Proyek* . CV. Pustaka Setia .
- Stevenson , J. (2009). *Operations Management* . America : McGraw Hill Companies .