CERUCUK
Volume 9 No. 5 2025 (195-204)

SCHEDULING STUDY USING *PRECEDENCE DIAGRAM METHOD* (PDM) IN THE IMPLEMENTATION OF THE SOUTH KALIMANTAN PROVINCIAL SOCIAL SERVICE DEVELOPMENT PROJECT PHASE-II

Nabila Azzahra1, Abdul Karim2
Civil Engineering Study Program, Lambung Mangkurat University
Jl. Jenderal Achmad Yani Km 35.5 Banjarbaru, South Kalimantan – 70714
E-mail : 1nabilaazzahrahusyairin@gmail.com, 2

ABSTRACT

Scheduling is one of the benchmarks of success in a construction project, apart from quality and budget. Therefore, the South Kalimantan Provincial Social Service Office Construction Project Phase-II requires good planning so that at the next stage it can be evaluated so that it can be completed on time or faster.

In the study, the *Precedence Diagram Method* scheduling method was used which can provide visualization of the dependency relationship between work items in a project with the help of *the Ms.Project* 2021 application to determine the total duration and critical trajectory with *a network diagram*, by entering the job description, duration and dependency relationships between work items. By using Scheduling, PDM can evaluate work in the field because it can display *Early Start*, *Latest Start*, *Early Finish*, *Latest Finish* and also critical tracks so that it is easier to identify critical tracks to optimize existing resources.

From the results of the research carried out, the PDM method has a total duration of 138 days starting on July 5, 2023 and ending on November 19, 2023 and found the most critical trajectories in concrete work in the South Kalimantan Provincial Social Service Office Construction Project Phase-II

Keywords: *Precedence Diagram Method* (PDM), *Microsoft Project* 2021, Critical Trajectory.

ABSTRACT

Scheduling is a crucial factor in the success of any construction project, along with quality and budget. Therefore, the construction project of South Kalimantan Province Social Service Office Phase II requires careful planning to serve as a benchmark for evaluation, ensuring timely or even accelerated completion.

This research employed the Precedence Diagram Method (PDM) for scheduling, which provides a visual representation of the dependencies between project activities. Microsoft Project 2021 was utilized to determine the overall duration and critical path through a network diagram by inputting activity descriptions, durations, and dependencies. PDM scheduling enables on-site evaluation by displaying early start, latest start, early finish, latest finish, and critical paths, facilitating the identification of critical paths to optimize resource allocation.

The results showed that the PDM method yielded a total duration of 138 days, commencing on July 5, 2023, and concluding in 19 November 2023. The critical path was predominantly found in concrete works for the South Kalimantan Province Social

Service Office Phase II construction project.

Keywords: Precedence Diagram Method (PDM), Microsoft Project 2021, Critical Path.

1. INTRODUCTION

Regional Regulation Number 17 of 2009 concerning the Regional Long-Term Development Plan (RPJPD) changed the location of the South Kalimantan Provincial Social Service office from Banjarmasin to Banjarbaru. Since March 23, 2022, the Public Works and Spatial Planning Office of South Kalimantan Province has started construction in stages. Construction is carried out in two stages. First, the erection and construction of the lower structure is carried out with a target of 30% physical achievement. Furthermore, structural and pipeline work is carried out with a physical achievement target of 20%. Finally, wall and roof structure work is carried out with a target of 50% physical achievement.

Precedence Diagram Method (PDM) is a scheduling technique that falls under the category of network scheduling techniques or long-term plans. PDM has advantages compared to CPM because PDM does not require fictitious or *dummy* activities, which makes network creation easier. This is due to the fact that various *overlapping* relationships can be created without increasing the number of activities. PDM also has constrains. Only one constrain can connect two nodes that each have two ends, with the beginning = S and the end = F.

In the PDM method, it can be known *Early Start*, *Latest Start*, *Early Finish*, *Latest Finish*, Relationship of dependence on work and critical trajectory, so that the implementing party can review and consider time management on the project. So the researcher is interested in researching the problem of project scheduling using the PDM method in the South Kalimantan Provincial Social Service Development Project Phase-II because using PDM can produce scheduling and s-curves up to level 4 which can be described in the form of *a network*. Meanwhile, in the scheduling in the project, only the *barchart scheduling method* is used with s-curve monitoring up to level 3 (three) and the critical trajectory cannot be known.

2. THEORETICAL FOUNDATIONS

Work Breakdown Structure It is a procedure for dividing project activities into its components. This approach is used to describe, elaborate, and divide a complete systematic project into smaller projects or manageable parts in the form of a dendrogram. WBS is very useful for planning, organizing, and managing large and small project processes (Maddeppungeng et al., 2015).

(Widiasanti & Lenggoni, 2013) states that a construction project schedule typically includes time, labor, equipment, materials, and financial planning. It is also a tool for determining when an activity starts and ends. Project time constraints can reduce construction costs, project delays, disputes, and claims.

According to (Santosa, 2008), the schedule can be implemented after the project tasks are divided into work packages. It is crucial to consider the time it will take to process each work package, as well as the events that will occur from a particular work package.

In the PDM Method, the activity depicted with a rectangular symbol is also called *Activity On Node* (AON) because it is located in the node area The advantages of the PDM method when compared to *the Arrow Diagram* are as follows:

1. Creating a network is easier because it does not require fictitious or *dummy activities*.
2. Can create many overlapping relationships without increasing the number of activities.

(Ervianto, 2009)

According to (Maha mahani, 2019), Forward and backward calculations to identify key activities and determine the critical path of the project. Forward calculations calculate the earliest start (ES) and earliest end (EF) measures, and countdown calculations calculate the last start (LS) and last end (LF) measures.

If there is more than one activity *predecessor* In advanced calculations that have different constraint relationships with FF, FS, SS, SF, ES and EF are taken the most. If the countdown includes advanced activities with different dependencies (constraints), LS and LF are taken the least (Amani et al., 2012).

The term "*Slack*" or "*Float*" refers to a loose time frame for performing a task, which can delay the performance of a task to its highest limit, depending on the slack or float level. Uninterrupted project schedules (Maha mahani, 2019).

Critical trajectories, or critical paths, determine the duration of a project and cannot be postponed. Delays in work on this track will slow down or shorten the duration of the project. The network approach uses a critical path, which consists of a series of critical activities from the first activity in the project to the last, each of which has the shortest completion time and longest duration. Critical paths are critical to the success of a project. Because there are activities on this route that have not been completed (Maha mahani, 2019).

If an activity meets the following requirements, it can be designated as a critical activity when planning using PDM:

a. The earliest start time and the latest finish time are the same (ES = LS)
b. The earliest finish time and the latest finish time are also the same (EF = LF)
c. The duration of the activity can be calculated as the difference between the last finish time and the earliest start time (LS - ES = D)
d. The total float is equal to zero, which means LF - ES = LS - ES

(Amani et al., 2012)

Microsoft Project is a project management programming software that is commonly used to plan, monitor, filter, and report information from activities, especially activities within a project. Advantages and disadvantages *Microsoft Project* in viewing and creating worksheets and component levels of task creation *software* It is very stable for the project management process. *Microsoft Project* It is usually used to operate, plan, manage, monitor, and report on activities in a project (Indra Khaidir et al., 2022).

3. METHOD

The primary and secondary data that have been obtained are then processed in accordance with the objectives and research design as follows:

1. The job description data that has been obtained will be made into the *Work Breakdown Structure* (WBS).
2. Calculate the duration of work for each item, using the 2023 AHSP labor coefficient to calculate job productivity.
3. The dependency relationship analysis of the PDM Method, which includes *start to start* (SS), *start to finish* (SF), *finish to finish* (FF), and also *finish to start* (FS). This analysis was carried out by conducting interviews with contractors.

4. The data was processed using the PDM method with the help of *the Ms. Project* 2021 application and scheduling was generated in the form of *a Network Diagram* of the entire project.
5. Creating the results of the S *Early Start* and *Latest Start* curves with *the Precedence Diagram Method* (PDM).

4. RESULTS AND DISCUSSION

A weekly report containing job descriptions, job volume, job weight, and S-curve is obtained. For the duration of the work, the results of calculations and interviews with the contractor of the South Kalimantan Provincial Social Service Office Construction Project Phase-II are the source of data. Table 4.1 shows the data

Table 4. 1 Dependence Relationship Between Jobs in the South Kalimantan Provincial Social Service Office Construction Project Phase-II

NO	Job Name	Code	Duration (Days)	Previous Work	Relationship	Was	Lead
I Preparation and Construction Safety Management System							
1.	Site cleaning	3	14	Start	-		
2.	Activity Signboard	4	1	Start	-		
II Structural Work							
A. Preparatory Work							
1.	Ulzet & Bowplank Pairing	7	1	3; 4	SS; FS		7; 0
2.	Rough sirtu urugan, compacted	8	17	7	FS		
3.	Drain the sand under the floor t=10 cm	9	2	8	SS	7	
4.	Land in the building	10	13	9	SS		
5.	Soil compaction	11	12	10	SS		7
B. Concrete Work							
Concrete Works up to Elevation -0.05							
1.	Sloof S2 beam, size 25x50						
	- Cor beton ready mix K-300	16	2	15	FS		
	- Pembesian	14	5	11	FS		
	- Formwork Sloof	15	11	14	SS		3
2.	Sloof S1 beam, size 30x60						
	- Cor beton ready mix K-300	20	2	19	FS		
	- Pembesian	18	8	14	SS		
	- Formwork Sloof	19	15	18	SS		4
3.	Concrete rebate t.7 cm underfloor -0.05						
	- Cor concrete	23	4	22	FS		
	- Foundation formwork	22	2	16, 20	FS		
Column, Beam and Floor Plate Works, Elevation -0.05 to +4.95							
1.	Column K-1, size 40x40						
	- Cor beton ready mix K-300	27	2	26	FS		
	- Pembesian	25	6	23	FS		
	- Column formwork	26	11	25	SS		3
2.	Column K-2, size 30x30						
	- Cor beton ready mix K-300	31	1	30	FS		
	- Pembesian	29	1	25	SS		
	- Column formwork	30	2	29	SS		
3.	Block B1, size 30x60						
	- Cor beton ready mix K-300	35	3	34	FS		
	- Pembesian	33	9	27, 31	FS		

	- Formwork balok	34	13	33	SS		5
4.	BA beam, size 25x50						
	- Cor beton ready mix K-300	39	2	38	FS		
	- Pembesian	37	6	33	SS		
	- Formwork balok	38	13	37	SS		3
5.	Concrete Plate Floor -2 (elevation +4.95)						
	- Cor beton ready mix K-300	43	3	42	FS		
	- Pembesian	41	14	35, 39	FS		
	- Bekisting plat	42	21	41	SS		7
III. Plumbing Work							
Used Water Works							
1.	2" diameter AW Type PVC Pipe	47	9	46	SS		
2.	4" diameter AW Type PVC Pipe	46	6	43	FS		

4.1 Forward and Backward Calculations

To create the S-curve for *Latest Start* and *Early Start*, forward and backward calculations are required. Forward calculations are performed to obtain *Earliest Start* (ES) and *Earliest Finish* (EF) values, and countdown calculations are performed to obtain *Latest Start* (LS) and *Latest Finish* (LF) values. The results of the forward and backward calculations are shown in Table 4.2.

Table 4. 2 Forward Calculation and Backward Calculation on Scheduling

NO	Code	Duration (Days)	Forward Calculation		Countdown	
			IS	EF	LS	LF
1.	3	14	0	14	0	14
2.	4	1	0	1	6	7
4.	7	1	7	8	7	8
5.	8	17	8	25	8	25
6.	9	2	15	17	15	17
7.	10	13	15	28	15	28
8.	11	12	22	34	22	34
9.	16	2	48	50	53	55
10.	14	5	34	39	34	39
11.	15	11	37	48	42	53
12.	20	2	53	55	53	55
13.	18	8	34	42	34	42
14.	19	15	38	53	38	53
15.	23	4	57	61	57	61
16.	22	2	55	57	55	57
17.	27	2	75	77	75	77
18.	25	6	61	67	61	67
19.	26	11	64	75	64	75
20.	31	1	63	64	76	77
21.	29	1	61	62	74	75

22.	30	2	61	63	74	76
23.	35	3	95	98	95	98
24.	33	9	77	86	77	86
25.	34	13	82	95	82	95
26.	39	2	93	95	96	98
27.	37	6	77	83	80	86
28.	38	13	80	93	83	96
29.	43	3	126	129	126	129
30.	41	14	98	112	98	112
31.	42	21	105	126	105	126
32.	47	9	129	138	129	138
33.	46	6	129	135	129	135

4.2 Critical Trajectory

A critical path is a trajectory with activities with a total *float* = 0. This trajectory determines the duration of the project, all activities cannot be postponed, and delays will cause the project to be pushed back or reduced.

Here is one example of a calculation for determining the critical trajectory in the C17 job code (Formwork on B1, Size 30x60)

Known:

ES = 82	Duration : 13 days	EF = 95
Job Code : C17		
LS = 82	TF : 0	LF = 95

Condition:

1. ES = LS → = 82 (meet)
2. EF = LF → = 95 (meet)
3. Duration = 13 days

   LF – ES = D → 95 – 82 = 13 (satisfying)

   LF – EF = LS – ES = 0 → 95 – 95 = 82 – 82 = 0 (meet)

When a job meets these requirements, it can be said to be a job that is on a critical trajectory. After the analysis, it can be known that the critical and non-critical work is as shown in Table 4.3.

NO	JOB DESCRIPTION	CODE	STATUS
I Preparation and Construction Safety Management System			
1.	Site cleaning	A1	Critical
2.	Activity Signboard	A2	Not
II Structural Work			
A.	**Preparatory Work**		
1.	Ulzet & Bowplank Pairing	B1	Critical
2.	Rough sirtu urugan, compacted	B2	Critical
3.	Drain the sand under the floor t=10 cm	B3	Critical
4.	Land in the building	B4	Critical
5.	Soil compaction	B5	Critical
B.	**Concrete Works**		
	Concrete Works up to Elevation -0.05		
1.	Sloof S2 beam, size 25x50		
	- Pembesian	C1	Critical
	- Formwork Sloof	C2	No
	- Cor beton ready mix K-300	C3	No
2.	Sloof S1 beam, size 30x60		
	- Pembesian	C4	Critical
	- Formwork Sloof	C5	Critical
	- Cor beton ready mix K-300	C6	Critical
3.	Concrete rebate t.7 cm underfloor -0.05		
	- Foundation formwork	C7	Critical
	- Cor concrete	C8	Critical
	Floor Column & Plate Works, Elevation -0.05 to +4.95		
1.	Column K-1, size 40x40		
	- Pembesian	C9	Critical
	- Column Skip	C10	Critical
	- Cor beton ready mix K-300	C11	Critical
2.	Column K-2, size 30x30		
	- Pembesian	C12	No
	- Column formwork	C13	No
	- Cor beton ready mix K-300	C14	No
3.	Block B1, size 30x60		
	- Pembesian	C15	Critical
	- Formwork balok	C16	Critical
	- Cor beton ready mix K-300	C17	Critical
4.	BA beam, size 25x50		
	- Pembesian	C18	No
	- Formwork balok	C19	No
	- Cor beton ready mix K-300	C20	No
5.	Concrete Plate Floor -2 (elevation +4.95)		
	- Pembesian	C21	Critical
	- Floor plate formwork	C22	Critical
	- Cor beton ready mix K-300	C23	Critical
C.	**Plumbing Work**		
	Used Water Works		
1.	2" diameter AW Type PVC Pipe	D1	Critical
2.	4" diameter AW Type PVC Pipe	D2	Critical

5. CONCLUSION

Based on the research objectives and the results of the analysis carried out in the Final Project "Scheduling Study Using the PDM Method in the Implementation of the South Kalimantan Provincial Social Service Development Project Phase-II", conclusions can be drawn:

1. Scheduling using *the Precedence Diagram Method* (PDM) begins by processing the data that has been obtained from the contractor through interviews, namely the duration of the work and the relationship between the dependencies, and other data provided in the form of weight and volume per work item and the S-Curve 2021 by entering a job description, duration and dependency relationships between jobs, which will then produce *a Gannt Chart* and *Network Diagram*.
2. The critical trajectory in Phase-II of the South Kalimantan Provincial Social Service Office Construction Project is: Location cleaning, Soil preparation in the building, Soil compaction, S2 Ironing, S1 Sloof formwork, K-300 S1 ready mix concrete formwork, foundation formwork, concrete rebate cast, K1 column formwork, K-300 K1 ready mix concrete cast, B1 beam formwork, K-300 B1 ready mix concrete cast, floor plate formwork, Cast ready mix concrete K-300 plate 2" diameter AW type PVC pipe
3. It was found that the difference between the S Curve of project planning and the S Curve *of Early Start* and the S Curve *of Latest Start* that has been made by the researcher is in the duration which is the duration of *the Early Start* and the duration *of the Latest Start* obtained from the results of scheduling with the *Precedence Diagram Method and the weight* of the work that is entered is obtained by the quotient between the weight of the work and the duration *of the Early Start* or *Latest Start* according to the job.

BIBLIOGRAPHY

Amani, W., Helmi, & Irawan, B. (2012). Comparison of CPM, PDM, and Engineering Applications *Bar Chart*- S-curve on project scheduling optimization. Scientific Bulletin of Math. Stat. and its Application (Bimaster), *01(1), 15–22.*

Bambang Siswanto, A., & Afif Salim, M. (2019). Project Management.

Ervianto, W. I. (2009). Construction Project Management.

Herzanita, A. (2019). Penggunaan Standard WBS (*Work Breakdown Structure*) Pada Proyek Bangunan Gedung (*Using Of Standardized WBS* (*Work Breakdown Structure) in Building Project*). In J.Infras (Vol. 5, Issue 1).

Husen, A. (2009). Project Management.addeppungeng, A., Suryani, I., & Iskandar, M. (2015). Analysis of Scheduling Control of the Construction of the Administration Building of the University of Education Indonesia (UPI) Serang Campus Using *the Work Breakdown Structure* (WBS) Method and S-Curve. In *JURNAL FOUNDATIONASI* (Vol. 4, Issue 1).

Mahapatni, I. A. P. S. (2019). Construction Project Planning and Control Methods.

Rani, H. A. (2016). Construction Project Management.

Soeharto, I. (1999). Project Management.

Semarang Computer Ride. (2002). Practical Guide to Construction Project Management with *Microsoft Project* 2000. Yogyakarta : Andi Publisher.

Widiasanti, I., & Lenggoni. (2013). Construction Management.