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Comparison Of The S Curve With The CPM Method In Analyzing Project Scheduling

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Abstract*.Project management is managing projects by considering all aspects of construction projects. A project must run according to plan and can be completed on time, so planning is needed before a project runs; scheduling must be considered. Scheduling is an important step in determining the exact duration and sequence for each activity in the project to create a logically structured schedule that can be implemented realistically. Many methods can be applied in project scheduling, such as S Curve and CPM (Critical Path Method). The use of different scheduling methods is considered to affect the final result of scheduling. Therefore, it is necessary to analyze the two methods. The analysis was carried out by comparing the critical trajectory, duration, and cost of structural work on the Kediri Regency Stadium Design and Build Project produced by the two methods so that it can be concluded which method is more efficient. The results showed differences in critical trajectories in the S curve and the CPM methods. In addition, the difference in duration is obtained; the S curve method requires a work duration of 140 days with a cost of Rp 48,041,965,577.96. Meanwhile, the CPM method requires a work duration of 131 days at a cost of Rp 47,535,997,308.05. Based on the results, the CPM method is superior in terms of time and cost.*

Keywords*: Critical Path Method, S curve method, Critical path, Duration, Cost.*

BACKGROUND

The construction industry has a vital role in advancing various aspects of life, especially in the development of physical infrastructure. Careful planning is required to avoid delays that can impact the quality of work and increase project costs. Construction project scheduling is a key step in determining the duration and sequence of activities, with critical trajectories determining the crucial work that must be completed on time. There are various project scheduling methods, such as S Curve and CPM. The Kediri Regency Stadium Design and Build project uses the S Curve. However, this study will be compared with the CPM method to determine the scheduling efficiency of the two methods.

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THEORETICAL STUDY

Project Management

In project management, there are three main factors that determine the success of a project, namely time, cost, and quality (Asnuddin et al., 2018).

Adopting project management provides many advantages compared to traditional systems. The management process is important as a comprehensive and integrated system that aims to achieve effective results regarding cost, quality, and time (Nilawati & Dharsika, 2020).

Project management is an effort to manage project activities by considering the limitations of time and resources in order to achieve the ultimate goal (Astari et al., 2022).

Project management involves assessing how to organize and integrate human and material resources by applying advanced management techniques. It aims to achieve various objectives such as scope, quality, time, and budget (Sutomo et al., 2016).

The purpose of project management is to properly organize a project's implementation so that the project's quality is by agreed standards, within the target timeframe, and at an efficient cost (Arianie & Puspitasari, 2017)..

Scheduling

Scheduling is an important part of project planning because it involves establishing a time sequence for completing the project from the initial stage to the final stage (Ilwaru et al., 2018). Many methods can be applied in scheduling, such as the S curve and the critical path method (CPM). With the application of the scheduling method, a construction project can be completed.

A project is a component arising from the planning process, which provides an overview of the planned schedule and development of the project in terms of the performance of resources such as cost, labour, equipment, and materials, as well as the planned duration of the project with the development of time to complete it (Abadiyah et al., 2022).

1. S-curve

The S curve is a tool used to monitor project progress visually. The S curve illustrates the correlation between activities, the duration of the work, and the relative weight of each activity, which is realized as a percentage of the overall project (Sutopo & Hendarti, 2022). The S Curve combines bar charts and the Hannum Curve to illustrate and express quantitative values related to time (Maddeppungeng & Suryani, 2015).

S-curves are now indispensable instruments for both project planning and control, as well as for assessing overall advancement during project execution. Typically, owners, managers, and contractors rely on S-curves for project planning and control, given their ability to forecast cash flows and facilitate financial preparations ahead of the construction phase (Cristóbal, 2017).

2. Critical Path Method

Critical Path Method (CPM) is a network-based approach that applies a linear approach to evaluate cost and time. By reducing additional costs and accelerating several activities, each activity can be completed faster than planned. If the project requires faster completion, certain activities can be prioritized to be completed faster (Aggraini & Kartini, 2021). Critical path method (CPM) is a technique that is used to plan and control project time. A Network Diagram, often called an arrow diagram, is a visual representation of a project's network of activities or activities. This diagram represents activities with arrows and certain symbols to clarify the relationship between activities (Wibowo, 2020). In its application, the CPM method uses a single duration estimate to estimate or estimate the completion time of an activity. This method can be applied if the duration can be predicted precisely and does not vary too much (Hayun, 2005).

CPM involves more than just project scheduling; it also aids in monitoring subsequent activities. This ultimately prompts precautionary actions if the project manager anticipates any potential delays. The core of CPM lies in pinpointing crucial tasks necessary for project completion within the projected timeframe, while also categorizing tasks that can be postponed for rearranging skipped or overrun tasks (Barwa, 2017).

a. Networking

A Work network is an approach that is considered effective in determining the sequence and duration of activities in a project. This method is also useful for estimating the overall project completion duration (Hermanto et al., 2019). Work networks primarily focus on the reciprocal relationships between various work components represented or visualized in a network diagram (Lilyana, 2020).

Two steps must be considered when preparing the work network. The first step is the activity inventory process, in which the project is divided into major components, and each major component is further divided into subcomponents until the final work package is formed. This is a process known as Work Breakdown Structure. The second step is determining the dependency logic between activities, which requires the construction of a work network based on these dependencies, resulting in different types of work networks (Rachman & Iswendra, 2019).

b. Critical Trajectory

In scheduling using the CPM method, the critical trajectory is the most basic thing; the critical trajectory contains a list of work items that cannot be delayed, so work items that are on the critical trajectory must run on time.

A critical trajectory refers to a series of crucial activities that establish the timeline for finishing a project (Aulia & Cipta, 2023).

The critical trajectory is a series of important tasks that must be carried out. The critical trajectory is a series of tasks that last the longest, starting from the beginning to the end of the project (Wiratmani & Prawitasari, 2015).

RESEARCH METHODS

Types of Research

This research uses quantitative methods. Quantitative methods refer to information expressed in numerical form. Because of this nature, quantitative data can be analyzed and processed through the use of mathematical or statistical calculation methods (Bangun, 2016).

Research Stages.

1. Data Collection

In this study, secondary data was obtained from PT PP Urban, which is the main contractor. Secondary data obtained includes Analysis of Unit Price of Work (AHSP), S curve, structural work volume data, Cost Budget Plan (RAB), and weekly reports.

a. Unit Price Analysis

Unit price analysis entails computing the cost per unit for construction tasks by multiplying the number of materials, labour expenses, and equipment requirements by the respective rates of building materials, standard labour wages, and the rental or purchase costs of necessary equipment for completing one unit of work. (Alami et al., 2021).

b. Cost Budget Plan

A budget plan represents the costs required for each task in a construction project, with the aim of estimating the total costs required to complete the project. Basically, these costs are derived by multiplying the estimated volume by the corresponding unit price for each task (Alami et al., 2021).

c. The Volume of Structure Work

The structural work volume is a summary containing information on the amount of work related to the building section that needs to be done and completed during the construction project.

d. Weekly Report

The weekly report is a combination of a recapitulation of daily reports covering the physical progress of work for one week as well as important points that need to be emphasized (Siswanto & Baihaqi, 2017).

2. Data Analysis

Data analysis using the CPM method is carried out in five steps. The first step is the creation of a Work Breakdown Structure (WBS) on the scope of work of the first-floor structure to the fourth floor and determining the predecessor and successor. The second step is to calculate the daily productivity of workers and the duration of each work item. The third step is filling in the data on Microsoft Project 2013 software so that the scope of work on the critical trajectory is known. The fourth step is planning a network or making a list of project activities with a work network. The fifth step is to calculate the cost budget plan.

After the calculation is complete, a data comparison between the S curve method and the CPM method is carried out.

RESULTS AND DISCUSSION

The object reviewed in this study is the construction of the upper structure of floors 1-4 in the Kediri Regency Stadium *Design and Build* Project carried out by PT PP Urban with the value of the construction of the upper structure of floors 1-4 amounting to Rp 48,041,965.577.96 with an implementation time of 140 days and has 27 work items in the critical trajectory which includes first-floor work (Installation of Pile cap and Tie Beam Concrete, Installation of Floor Plate Concrete, Installation of Column Concrete, Installation of Pile cap and Tie Beam Formwork, Installation of Floor Plate Formwork, Installation of Column Formwork, Pile cap and Tie Beam Concreting, Floor Plate Concreting, Column Concreting), 2nd floor work (Installation of Pile cap and Tie Beam Concrete, Installation of Floor Plate Concrete, Concrete column installation, Pile cap and Tie Beam formwork installation, Floor Plate formwork installation, Column formwork installation, Pile cap and Tie Beam concreting, Floor Plate concreting, Column concreting), and 3rd floor work (Pile cap and Tie Beam rebar installation, Floor Plate rebar installation, Column rebar installation, Pile cap and Tie Beam formwork installation, Floor Plate formwork installation, Column formwork installation, Pile cap and Tie Beam concreting, Floor Plate concreting, Column concreting).

Work Breakdown Structure

Work breakdown structure is needed in scheduling to find out the details of the work to be done on a project. Work Breakdown Structure is presented in Table 1.

Calculation of daily labour productivity

Calculation of daily labour productivity is useful in determining the capacity of workers to carry out work within one day. In calculating labour productivity, the worker coefficient taken is the largest worker coefficient. The coefficient value is taken from the unit price analysis of PT. PP Urban's work. The daily productivity of workers can be calculated with the equation:

$$Daily\ productivity = \frac{1}{Worker\ coefficient} \times Number\ of\ Workers \text{ ..... (1)}$$

Example of daily productivity calculation on pile cap and tiebeam concrete ironing work:

Number of workers = 54

Worker coefficient = 0.0070

Daily productivity = 54/0.0070 = 7,714.29 kg/day

A recapitulation of the calculation of daily labor productivity is presented in Table 1.

Estimated Duration of Work

Estimated work duration needs to be calculated to estimate the time needed to complete a task. The duration of work can be calculated by the formula:

$$\text{Duration of work} = \frac{Volume\ of\ work}{Productivity\ value} \text{ ..... (2)}$$

Example of calculating the duration of work on Pile cap and Tie Beam ironing work:

Volume of work = 290,743.00 kg

Productivity value = 7,714.29 kg/day

Duration of work = 290,743.00/7,714.29

= 37.69 ≈ 38 days

A recapitulation of the calculation of estimated work duration is presented in Table 1

Table 1. Work Breakdown Structure, Daily Productivity of Workers, and Estimated Work Duration

NUM.		JOB LIST	WORKERS QUANTITY	VOLUME	VOLUME UNITS	PRODUCTIVITY	PRODUCTIVITY UNITS	DURATION (Days)
I		**UPPER STRUCTURE**						
		1st Floor						
		Concrete Iron						
	1	Pilecap dan Tie Beam	54	290.743,00	kg	7.714,29	kg/d	38
	2	Column	28	152.902,21	kg	4.000,00	kg/d	39
	3	Floor Plates	12	64.508,98	kg	1.714,29	kg/d	38
		Formwork						
	1	Pilecap dan Tie Beam	185	7.274,00	m2	355,77	m2/d	21
	2	Floor Plates	31	968	m2	46,97	m2/d	21
	3	Column	114	3.472,00	m2	172,73	m2/d	21
		Concrete Fc 30 Mpa (Equivalent to K-350)						
	1	Pilecap dan Tie Beam	34	1.636,00	m3	34	m3/d	49
	2	Floor Plates	33	1.539,07	m3	33	m3/d	47
	3	Column	13	590,28	m3	13	m3/d	46
		2nd Floor						
		Concrete Iron						
	1	Beam	55	298.924,00	kg	7.857,14	kg/d	38
	2	Column	19	107.267,71	kg	2.714,29	kg/d	40
	3	Floor Plates	20	109.947,41	kg	2.857,14	kg/d	39
		Formwork						
	1	Floor Plates	163	8.055,51	m2	246,97	m2/d	33
	2	Beam	110	5.194,00	m2	166,67	m2/d	32
	3	Column	57	2.887,01	m2	86,36	m2/d	34
		Concrete Fc 30 Mpa (Equivalent to K-350)						
	1	Beam	30	943	m3	30	m3/d	32
	2	Floor Plates	32	1.010,87	m3	32	m3/d	32
	3	Column	16	488	m3	16	m3/d	31
		3rd Floor						
		Concrete Iron						
	1	Beam	41	216.670,00	kg	5.857,14	kg/d	37
	2	Column	20	107.953,77	kg	2.857,14	kg/d	38
	3	Floor Plates	33	172.197,15	kg	4.714,29	kg/d	37
		Formwork						
	1	Floor Plates	208	9.971,92	m2	315,15	m2/d	32
	2	Beam	77	3.707,00	m2	116,67	m2/d	32
	3	Column	50	2.524,31	m2	75,76	m2/d	34
		Concrete Fc 30 Mpa (Equivalent to K-350)						
	1	Beam	22	672	m3	22	m3/d	31
	2	Floor Plates	43	1.317,80	m3	43	m3/d	31
	3	Column	13	441,75	m3	13	m3/d	34
		Level +12.350						
		Concrete Iron						
	1	Column	46	57.257,27	kg	6.571,43	kg/d	9
	2	Beam	46	55.025,00	kg	6.571,43	kg/d	9
	3	Floor Plates	2	2.617,00	kg	285,71	kg/d	10
		Formwork						
	1	Floor Plates	165	2.681,90	m2	250	m2/d	11
	2	Beam	75	1.288,00	m2	113,64	m2/d	12
	3	Column	90	1.400,22	m2	136,36	m2/d	11
		Concrete Fc 30 Mpa (Equivalent to K-350)						
	1	Floor Plates	27	261,7	m3	27	m3/d	10
	2	Column	27	245,04	m3	27	m3/d	10
	3	Beam	26	229	m3	26	m3/d	9
II		**STAIRS**						
		Outside Stadium Area Stairs						
	1	Concrete Iron	24	30.503,18	kg	3.428,57	kg/d	9
	2	Concrete	24	158,48	m3	24	m3/d	7
	3	Formwork	24	1.394,16	m2	36,36	m2/d	39
		Inside Stadium Area Stairs						
	1	Concrete Iron	24	6.482,98	kg	3.428,57	kg/d	2
	2	Concrete	24	30,86	m3	24	m3/d	2
	3	Formwork	24	277,71	m2	36,36	m2/d	8

Source: Data Processing (2024)

Critical Trajectory and Total Duration Analysis

After calculating the duration of each activity from the CPM method, data processing is carried out using Microsoft Project 2013 software by entering Work Breakdown Structure data, determining the start date of the work, entering the results of the calculation of the duration of the work, and creating a network planning pattern, after which the results of the critical path and project duration through the CPM method can be known. The arrangement of the network planning pattern is presented in Table 2.

Table 2. Network Planning Pattern

NUM		JOB LIST	CODE	PREDECESSOR	NUM		JOB LIST	CODE	PREDECESSOR
I		**UPPER STRUCTURE**			B		Formwork		
1		**1st Floor**				1	Beam	C21	B33 (SS+3)
A		Concrete Iron				2	Floor Plates	C22	C21 (SS)
	1	Pilecap dan Tie Beam	A11			3	Column	C23	C32 (FS-30)
	2	Floor Plates	A12	A11 (SS+1)	C		Concrete Fc 30 Mpa (Equivalent to K-350)		
	3	Column	A13	A11 (SS+2)		1	Beam	C31	C11 (SS+7)
B		Formwork				2	Floor Plates	C32	C31 (SS)
	1	Pilecap dan Tie Beam	A21	A11 (FS-21)		3	Column	C33	C23 (SS+1)
	2	Floor Plates	A22	A12 (FS-22)	4		**Level+12.350**		
	3	Column	A23	A32 (SS+7)	A		Concrete Iron		
C		Concrete Fc 30 Mpa (Equivalent to K-350)				1	Beam	D11	D21 (SS+30)
	1	Pilecap dan Tie Beam	A31	A21 (SS)		2	Floor Plates	D12	D11 (SS)
	2	Floor Plates	A32	A31 (SS+2)		3	Column	D13	D12 (SS+5)
	3	Column	A33	A23 (SS)	B		Formwork		
2		**2nd Floor**				1	Beam	D21	C33 (SS+7)
A		Concrete Iron				2	Floor Plates	D22	D21 (SS+1)
	1	Beam	B11	B21 (SS)		3	Column	D23	D32 (SS+5)
	2	Floor Plates	B12	B11 (SS)	C		Concrete Fc 30 Mpa (Equivalent to K-350)		
	3	Column	B13	B12 (SS+6)		1	Beam	D31	D11 (SS+1)
B		Formwork				2	Floor Plates	D32	D32 (SS)
	1	Beam	B21	A33 (SS+18)		3	Column	D33	D23 (SS+5)
	2	Floor Plates	B22	B21 (SS)	**II**		**STAIRS**		
	3	Column	B23	B32 (SS+1)	1		**Outside Stadium Area Stairs**		
C		Concrete Fc 30 Mpa (Equivalent to K-350)				1	Concrete Iron	E11	C33 (SS)
	1	Beam	B31	B11 (SS+14)		2	Concrete	E12	E13 (FS-5)
	2	Floor Plates	B32	B32 (SS)		3	Formwork	E13	E11 (SS+2)
	3	Column	B33	B23 (SS+3)	2		**Inside Stadium Area Stairs**		
3		**3rd Floor**				1	Concrete Iron	F11	C33 (SS)
A		Concrete Iron				2	Concrete	F12	F13
	1	Beam	C11	C21 (SS)		3	Formwork	F13	F11
	2	Floor Plates	C12	C11 (SS)					
	3	Column	C13	C12 (SS+4)					

Source: Data Processing (2024)

1. Total Duration and CPM Critical Trajectory

Based on the results of data processing on Microsoft Project 2013 software, the CPM method takes 131 days to complete the upper structure work and has 24 work items on the critical trajectory which includes first-floor work (Pile cap and Tie Beam Concrete Installation, Pile cap and Tie Beam Formwork Installation, Column Formwork Installation, Pile cap and Tie Beam Concreting, Floor Plate Concreting, Column Concreting), 2nd floor work (Beam Concrete Installation, Beam Formwork Installation, Column Formwork Installation, Beam Concreting, Floor Plate Concreting, Column Concreting), 3rd floor work (Beam Formwork Installation, Beam Formwork Installation, Column Formwork Installation, Beam Concreting, Floor Plate Concreting, Column Concreting), and Level +12,350 work (Beam Concrete Installation, Beam Formwork Installation, Column Formwork Installation, Beam Concreting, Floor Plate Concreting, Column Concreting).

Cost Analysis

2. CPM Total Cost

Cost calculations in this study were obtained by processing data manually and with the help of applications. The calculation of workers' wage costs was carried out with the help of Microsoft Project 2013 software by entering the number of workers' daily wages into the Resource Sheet menu in the software. The qualification of workers' daily wages is presented in Table 3.

Table 3. Worker's Daily Wage Qualification

NUM	JOB LIST		WORKERS QUANTITY	WORKER'S WAGES (Rp)	NUM	JOB LIST		WORKERS QUANTITY	WORKER'S WAGES (Rp)
1	1st Floor Iron Installation				10	Iron Installation at Elevation +12,350			
	a	Foreman	1	140.000,00		a	Foreman	1	140.000,00
	b	Chief of Craftsman	3	130.000,00		b	Chief of Craftsman	3	130.000,00
	c	Craftsman	8	105.000,00		c	Craftsman	8	105.000,00
	d	Worker	94	96.900,00		d	Worker	94	96.900,00
2	1st Floor Formwork Installation				11	Formwork Installation at Elevation +12,350			
	a	Foreman	3	140.000,00		a	Foreman	3	140.000,00
	b	Chief of Craftsman	3	130.000,00		b	Chief of Craftsman	3	130.000,00
	c	Craftsman	12	105.000,00		c	Craftsman	12	105.000,00
	d	Worker	330	96.900,00		d	Worker	330	96.900,00
3	1st Floor Concrete Casting				12	Concrete Casting at Elevation +12,350			
	a	Foreman	1	140.000,00		a	Foreman	1	140.000,00
	b	Chief of Craftsman	1	130.000,00		b	Chief of Craftsman	1	130.000,00
	c	Craftsman	4	105.000,00		c	Craftsman	4	105.000,00
	d	Worker	80	96.900,00		d	Worker	80	96.900,00
4	2nd Floor Iron Installation				13	Iron Installation on Outside Stadium Area Stairs			
	a	Foreman	1	140.000,00		a	Foreman	1	140.000,00
	b	Chief of Craftsman	3	130.000,00		b	Chief of Craftsman	1	130.000,00
	c	Craftsman	8	105.000,00		c	Craftsman	4	105.000,00
	d	Worker	94	96.900,00		d	Worker	24	96.900,00
5	2nd Floor Formwork Installation				14	Formwork Installation on Outside Stadium Area Stairs			
	a	Foreman	3	140.000,00		a	Foreman	1	140.000,00
	b	Chief of Craftsman	3	130.000,00		b	Chief of Craftsman	1	130.000,00
	c	Craftsman	12	105.000,00		c	Craftsman	4	105.000,00
	d	Worker	330	96.900,00		d	Worker	24	96.900,00
6	2nd Floor Concrete Casting				15	Concrete Casting on Outside Stadium Area Stairs			
	a	Foreman	1	140.000,00		a	Foreman	1	140.000,00
	b	Chief of Craftsman	1	130.000,00		b	Chief of Craftsman	1	130.000,00
	c	Craftsman	4	105.000,00		c	Craftsman	4	105.000,00
	d	Worker	80	96.900,00		d	Worker	24	96.900,00
7	3rd Floor Iron Installation				16	Iron Installation on Inside Stadium Area Stairs			
	a	Foreman	1	140.000,00		a	Foreman	1	140.000,00
	b	Chief of Craftsman	3	130.000,00		b	Chief of Craftsman	1	130.000,00
	c	Craftsman	8	105.000,00		c	Craftsman	4	105.000,00
	d	Worker	94	96.900,00		d	Worker	24	96.900,00
8	3rd Floor Formwork Installation				17	Formwork Installation on Inside Stadium Area Stairs			
	a	Foreman	3	140.000,00		a	Foreman	1	140.000,00
	b	Chief of Craftsman	3	130.000,00		b	Chief of Craftsman	1	130.000,00
	c	Craftsman	12	105.000,00		c	Craftsman	4	105.000,00
	d	Worker	330	96.900,00		d	Worker	24	96.900,00
9	3rd Floor Concrete Casting				18	Concrete Casting on Inside Stadium Area Stairs			
	a	Foreman	1	140.000,00		a	Foreman	1	140.000,00
	b	Chief of Craftsman	1	130.000,00		b	Chief of Craftsman	1	130.000,00
	c	Craftsman	4	105.000,00		c	Craftsman	4	105.000,00
	d	Worker	80	96.900,00		d	Worker	24	96.900,00

Source: PT. PP Urban (2024)

After the analysis, the total cost of worker wages is Rp 8,525,699,900.00. After calculating the wages of workers, it is necessary to calculate the cost of construction work materials. The cost of construction materials can be calculated with the equation:

Material cost = AHSP material cost × total volume ..... (3) A recapitulation of AHSP costs and total work volume is presented in Table 4.

Table 4. Recapitulation of AHSP Cost and Total Volume of Work

NUM	JOB LIST	AHSP FEES (Rp)	TOTAL VOLUME
1	Installation of 1m^2 of Building Foundation Formwork	44.513,33	7.274,00
2	Installation of 1m^2 Floor Plate Formwork	104.373,33	21.677,33
3	Installation of 1m^2 Column Formwork	75.040,00	10.283,54
4	Installation of 1m^2 Beam Formwork	78.240,00	10.189,00
5	Installation of 1m^2 Stairs Formwork	68.888,33	1.671,87
6	Installation of 1kg iron	11.213,48	1.672.999,65
7	Making 1m^3 Concrete f'c = 32,1 Mpa (K350)	1.219.000,00	9.563,86

Source: PT. PP Urban (2023)

Example of calculation of material cost for 1m2 formwork installation work:

AHSP material cost = IDR 44,513.33/m2

Total formwork installation volume = 7,274.00 m2

Iron material cost = 44,513.33 × 7,274.00

= IDR 323,789,986.67

A recapitulation of the total project material costs is presented in Table 5.

Table 5. Recapitulation of Total Material Cost

NUM	JOB LIST	TOTAL COST
1	Installation of 1m^2 of Building Foundation Formwork	Rp 323.789.986,67
2	Installation of 1m^2 Floor Plate Formwork	Rp 2.262.535.095,26
3	Installation of 1m^2 Column Formwork	Rp 771.677.141,76
4	Installation of 1m^2 Beam Formwork	Rp 797.187.360,00
5	Installation of 1m^2 Stairs Formwork	Rp 115.172.089,85
6	Installation of 1kg iron	Rp 18.760.139.697,94
7	Making 1m^3 Concrete f'c = 32,1 Mpa (K350)	Rp 11.658.341.735,84
	Total Cost	Rp 34.688.843.107,32

Source: Data Processing (2024)

After obtaining the cost of workers and material costs, the total cost of workers and material costs will be summed up with the cost of profit from the total cost. Based on the Regulation of the Minister of PUPR No. 8 of 2023 Chapter II Article 11 paragraph 3, it is explained that general costs and profits can be calculated at 10% (ten percent) to 15% (fifteen percent) of direct costs. In this study, a general cost and profit planning of 10% (ten percent) is used.

Project Cost = IDR 8,525,699,900.00 + IDR 34,688,843,107.32

= IDR 43,214,543,007.32

Profit Cost = 10% × IDR 43,214,543,007.32

= IDR 4,321,454,300.73

Total Project Cost = IDR 43,214,543,007.32 + IDR 4,321,454,300.73

= IDR 47,535,997,308.05

After calculating the cost, the project cost is IDR 47,535,997,308.05.

CONCLUSION AND SUGGESTIONS

The results of the study show that the S curve method has 27 work items included in the critical trajectory, takes 140 days to complete the construction of the upper structure, and costs IDR 48,041,965,577.96. The CPM method has 24 work items included in the critical trajectory, takes 131 days to complete the construction of the upper structure, and costs IDR 47,535,997,308.05. The CPM method scheduling planning shows a difference in the duration of the upper structure work, which is nine days shorter and has a lower cost, with a difference of IDR 505,968,269.91. Based on this, it can be concluded that the CPM method is more efficient in terms of cost and time than the S curve method.

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