Time and Cost Estimation of Watu Sewu Bridge Construction on the South Cross Road LOT 7 Project Blitar

Laili Dian Saputri and Achmad Faiz Hadi Prajitno

Department of Civil Infrastructure Engineering, Institut Teknologi Sepuluh Nopember (ITS)
Corresponding Author: afhadip@gmail.com

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ABSTRACT

The Southern Cross Road project is a project that aims to facilitate transportation in the south of East Java. One of the segments on the Southern Crossing Road is the LOT 7 project that connects the Tulungagung Regency boundary – Serang – Malang Regency boundary. This study discussed the construction of the Watu Sewu Bridge, which is one of the works in the Southern Cross Road project. This bridge used a concrete main structure and a steel frame. During the construction process, there were several obstacles, such as unfavorable weather and difficult field conditions that resulted in project delays. Time planning and selecting the proper implementation method can assist in managing resources effectively and efficiently. This study planned construction management for the Watu Sewu Bridge construction, which consists of the substructure, superstructure, and pavement structure work. This study was prepared by identifying work items and calculating volume and productivity. These calculations were used to determine the duration and cost of implementation. Project scheduling used the critical path method using the Microsoft Project program. Based on the analysis results, it was obtained the final results of the duration and time of implementation, network planning, and S curve. It is known that the implementation time for the construction of the Watu Sewu Bridge was 154 calendar days, and the implementation cost was IDR 22.312.359.417.

INTRODUCTION

As the population grows rapidly, adequate transportation facilities are needed. By reviewing the importance of construction development in a region, the Ministry of Public Works and Housing (PUPR) plans the construction of Southern Cross Road, which aims to facilitate transportation in East Java. The project began in 2002 and passed through eight regencies/cities, namely Pacitan, Trenggalek, Tulungagung, Blitar, Malang, Lumajang, Jember, and Banyuwangi, aims to facilitate logistics distribution and increase investment in the southern region of East Java. One of the segments on the Southern Crossing Road is the LOT 7 project that connects the Tulungagung Regency boundary - Serang - Malang Regency boundary.

The construction of Watu Sewu Bridge is part of South Cross Road LOT 7 Project Blitar with a span length of 155.35m. The bridge consists of a PCI girder bridge and a steel truss bridge. The distance between abutment AI and pillar P1 is 31.05 m, the distance between pillar P1 and pillar P2 is 61.9 m, the distance between pillar P2 and pillar P3 is 31.35 m, and the distance between pillar P3 and pillar P4 is 31.05 m.

A development project must pay attention to good implementation planning to obtain maximum results. Activity schedules, implementation costs, duration, and implementation methods are important elements of management that must be applied to project implementation. However, it is undeniable that there are some problems during the project that can hinder implementation. The construction of this bridge experienced a shift in implementation time due to weather and quite difficult field conditions. Thus, it is important for planners to choose the right method and scheduling so that the required costs are as minimal as possible.

Construction implementation management focusing on planning implementation methods, implementation duration calculation, scheduling, and budgeting implementation costs is the topic of discussion in this study. The method used in this study is to directly review the project and obtain field data and analyze the time and cost calculations of each work item. Then, with the help of Ms. Project software, network planning is determined to determine the critical trajectory of project activities. The objectives of this study are the implementation method, total implementation time, project scheduling, and total cost of constructing Watu Sewu Bridge on the South Cross Road LOT 7 Project Blitar.

LITERATURE REVIEW

A. General

Project management is an effort to use expertise and

Table 1. Equipment Efficiency

Operating Condition	Efficiency Factor
Good	0.83
Fair	0.75
Deficient	0.67
Poor	0.58

Source: AHSP of Ministry of Public Works Regulation 28, 2022

Table 2. Operator and Mechanical Factors

Qualification	Identity	Value
Skilled	STM/equivalent education SIMP/SIPP (III) certification Experience > 6000 hours	0.8
Enough	STM/equivalent education SIMP/SIPP (III) certification 4000-6000 hours of experience	0.7
Moderate	STM/SIPP (III) education SIMP/SIPP (III) certification 2000-4000 hours of experience	0.6
Poor	STM/equivalent education	0.5

Source: Reference Book for Building and Civil Contractors Civil, 2013

Table 3. Weather Factors

Weather Condition	Minute/Hour	%
Bright, hot, dusty	50/60	0.83
Overcast	45/60	0.75
Dark	40/60	0.66

Source: Reference Book for Building and Civil Contractors Civil, 2013

skills in technical implementation and limited resources to obtain optimal results in terms of cost, quality, time performance, and work safety (Husen, 2010). In a management plan, work items are arranged in advance in sequence and have an interdependent relationship with each work item. The bridge project implementation method includes foundation work, namely drilling, substructure and superstructure, and pavement work. In constructing the structure, supporting equipment is also required, namely heavy equipment such as drilling equipment, diggers, soil compactors, casting equipment, and transportation equipment.

B. Project Scheduling

1. Preparatory Work
   a. Cleaning Work
   b. Embankment Work (Access Road)
2. Subtructure Work
   a. Drilling Work
   b. Working Floor Work
   c. Pile cap Work
   d. Pillar Work
   e. Pier Head Work
   f. Abutment Work
   g. Wing Wall Work
   h. Stepping Plate Work
3. Superstructure Work
   a. Mortar Pad Work
   b. Bearing Pad Work
   c. Girder Stressing
   d. Erection PCI Girder
   e. Steel Frame Erection
   f. Diaphragm Work
   g. Deck Slab Work
   h. Parapet Work
   i. Sidewalk Work
4. Pavement Work
   a. Tack Coat Work
   b. AC-WC Coating

C. Volume Calculation

Volume calculation refers to the working drawings obtained from the project. After obtaining the volume calculation results, then calculate the time and cost of each work item. Volume calculation formula can be seen as follows.

Formwork volume (m^2) = p x l
Casting volume (m^3) = p x l x t
Reinforcement volume (kg)= p x reinforcement weight (kg/m)
Where:
p = Length (m)
l = Width (m)
t = Height (m)

D. Labor Requirements Calculation

The calculation of the maximum number of workers refers to the HSPK (Basic Unit Activity Price) of Blitar Regency in 2021. The determination of the maximum number of laborers can be seen as follows.

a. $Foreman = \frac{Foreman\ Coefficient}{Foreman\ Coefficient}$

b. $Builder = \frac{Builder\ Coefficient}{Foreman\ Coefficient}$

c. $Labor = \frac{Labor\ Coefficient}{Foreman\ Coefficient}$

E. Heavy Equipment

Heavy equipment is generally categorized into several classifications, namely earthmoving equipment, digging equipment, transport equipment, material transfer equipment, compaction equipment, and others. In operating heavy equipment, several things need to be considered, namely the efficiency factor of the equipment, operator and mechanical factors, and weather factors.

The following are the details of the heavy equipment used and the productivity calculation.

a. Excavator Backhoe Komatsu PC 200

Excavators are used to excavate, load, and lift materials. Backhoes are used in subsurface excavation work and for excavating hard materials and will obtain flat excavation results. The following is the calculation of the backhoe excavator production capacity.

Production capacity

$$Q = \frac{V \times Fb \times Fa \times 60}{Ts \times Fv}$$

Where:
V = Bucket capacity m^3
Fb = Bucket factor
Fa= Equipment efficiency factor
Ts= Cycle time

b. Bulldozer D65

Bulldozers are heavy equipment related to earthmoving or land processing. The following is the calculation of bulldozer productivity.

Production capacity,

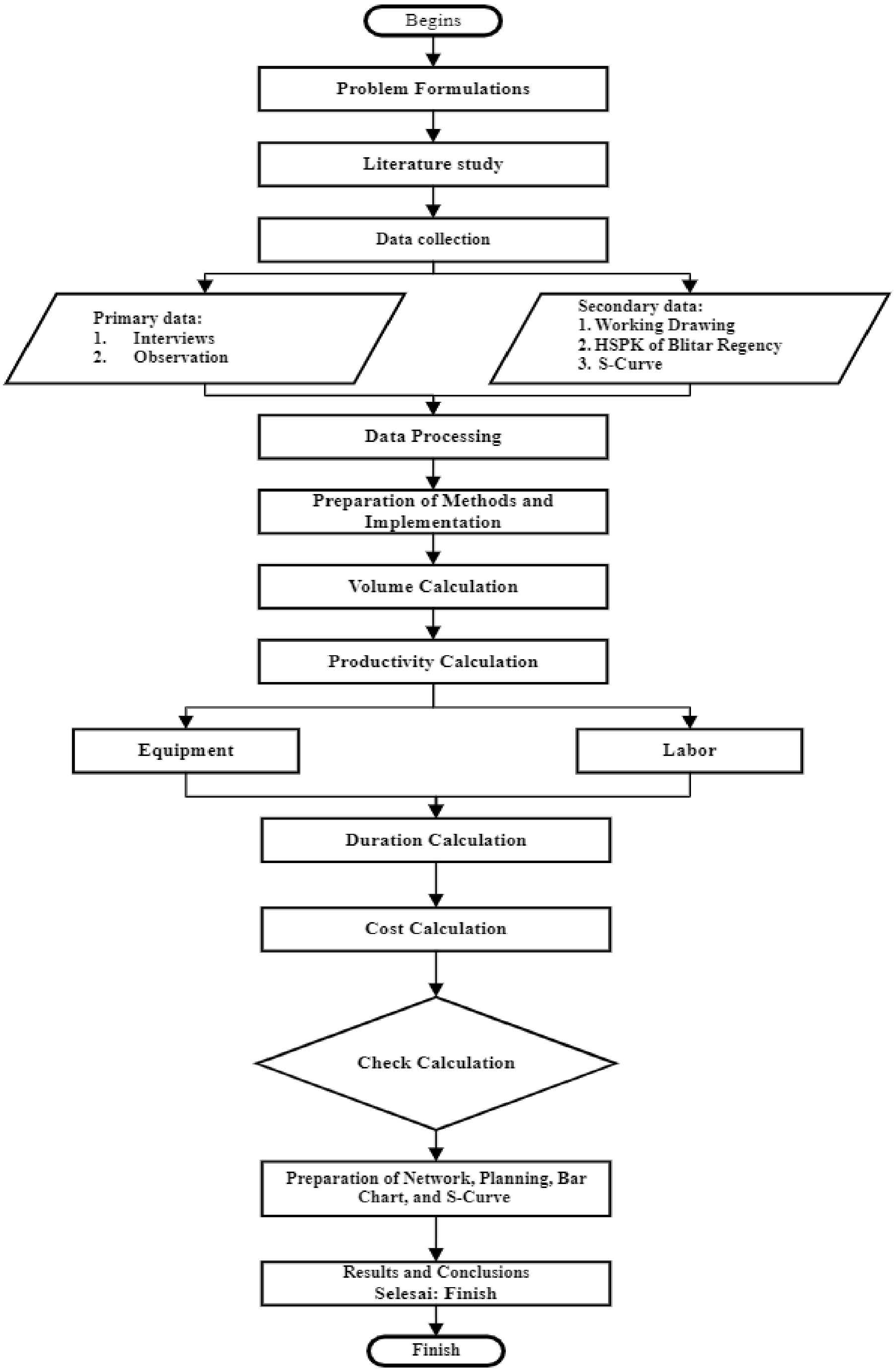

Figure 1. Methodology Flowchart

$$Q = \frac{q \ x \ Fb \ x \ Fm \ x \ Fa \ x \ 60}{Ts}$$

Where:
Fb = Blade factor, taken 1
Fa = Equipment efficiency factor
Fm = Equipment slope factor
Ts = Cycle time

c. Crawler Crane Kobelco 180 T

Crawler cranes are used for the erection of prestressed bridges and prestressed concrete panel components. In addition, also used in bored pile foundation work, pipe installation, digging, and loading (Ministry of Public Works, 2013). The following is the calculation of crawler crane productivity.

Production capacity,

$$Q = \frac{V \times Fa \times 60}{Ts}$$

Where:
V = Production capacity
Fa = Equipment efficiency factor
Ts = Cycle time

d. Concrete Pump Super Longboom Sany SYG

Concrete pumps are used to move the concrete mixture during casting. The concrete to be pumped must meet a particular slump according to the requirements in the concrete pump specifications.

e. Borepile Machine Sany SR 150

This heavy equipment is used to carry out the bored pile work with drill bit tips in the form of drilling buckets and augers. The diameter of the drilling is adjusted to the

Table 4. Work Volume Recapitulation

Work Description	Volume	Unit	Work Description	Volume	Unit
A. Preparatory Work			Abutment Work		
Land clearing	18000	m^3	Fabrication of abutment reinforcement	21109,9	kg
Embankment work	3750	m^3	Installation of abutment reinforcement	21109,9	kg
Structure excavation work	1517,9	m^3	Fabrication of abutment formwork	224,4	m^2
B. Substructure Work			Installation of abutment formwork	224,4	m^2
Bored pile work			Abutment casting	98,4	m^3
Drilling work	396	m	Dismantling and repair of abutment formwork	224,4	m^2
Fabrication of bored pile reinforcement	44846,2	kg	Wing Wall Work		
Installation of bored pile reinforcement	44846,2	kg	Fabrication of wing wall reinforcement	14671,7	kg
Bored pile casting	311	m^3	Installation of wing wall reinforcement	14671,7	kg
Bored pile cutting	54	point	Fabrication of wing wall formwork	134,7	m^2
Working floor work			Installation of wing wall formwork	134,7	m^2
Blank stone work	81	m^3	Wing wall casting	15,1	m^3
Lean concrete casting	40,5	m^3	Dismantling and repair of wing wall formwork	134,7	m^2
Pile cap Work			Stepping plate work		
Fabrication of pile cap reinforcement	93729	kg	Fabrication of stepping plate reinforcement	5528,1	kg
Installation of pile cap reinforcement	93729	kg	Installation of stepping plate reinforcement	5528,1	kg
Fabrication of pile cap formwork	454,7	m^2	Setting and installing stepping plate formwork	23,7	m^2
Installation of pile cap formwork	454,7	m^2	Stepping plate casting	27,7	m^3
Pile cap casting	877,5	m^3	Dismantling and repair of stepping plate formwork	23,7	m^2
Dismantling and repair of pile cap formwork	454,7	m^2	C. Superstructure Work		
Pillar work			Mortar pad work		
Pillar reinforcement fabrication	97326,1	kg	Fabrication and installation of mortar pad reinforcement	586,3	kg
Installation of pillar reinforcement stage 1	1688	kg	Fabrication and installation of mortar pad formwork	0,01	m^2
Installation of pillar reinforcement stage 2	78841,6	kg	Mortar pad casting	0,6	m^3
Fabrication and installation of plate formwork	79,2	m^2	Formwork dismantling and repair	0,01	m^2
Multiplex formwork fabrication	50,4	m^2	Bearing pad work		
Fabrication and installation of plate formwork	79,2	m^2	Bearing pad installation	36	piece
Pillar casting	120,4	m^3	Stressing work		
Dismantling and repair of plate formwork	79,2	m^2	Stressing work	18	piece
Dismantling and repair of multiplex formwork	50,4	m^2	Erection PCI Girder work		
Dismantling and repair of plate formwork	79,2	m^2	Erection girder AI-P1	6	piece
Embankment Work			Erection girder P2-P3	6	piece
Backfill work	515	m^3	Erection girder P3-A2	6	piece
Pier head work			Truss bridge erection		
Pier head reinforcement fabrication	68229,1	kg	Steel frame erection	152967	kg
Pier head reinforcement installation	68229,1	kg	Diaphragm Work		
Fabrication of pier head formwork	419,6	m^2	Diaphragm reinforcement fabrication	3379	kg
Installation of pier head formwork	419,6	m^2	Diaphragm reinforcement installation	3379	kg
Pier head casting	324,9	m^3	Diaphragm formwork fabrication	370,2	m^2
Dismantling and repair of pier head formwork	419,6	m^2	Diaphragm formwork installation	370,2	m^2

drill tip used. The following is the calculation of bored pile equipment productivity.

Production capacity,

$$Q = \frac{V\ x\ p\ x\ Fa\ x\ 60}{Ts}$$

Where:

p = Drilling depth
V = 1 point-equipment capacity
Fa = Equipment efficiency factor
Ts = Cycle time

f. Asphalt Finisher

Asphalt finisher is equipment to spread the hot mix asphalt mixture produced from asphalt production equipment, namely Asphalt Mixing Plant [AMP], on the road surface to be worked on. The following is the calculation of the asphalt finisher productivity.

Production capacity,

$$Q = V \text{ x } b \text{ x } Fa \text{ x } 60 \text{ x } t \text{ x } D1$$

Where:

b = Spraying width
V = Spreading speed
Fa = Equipment efficiency factor
t = Coating thicknesses

g. Tandem Roller

This equipment is generally used on fairly smooth surfaces, such as asphalt rollers (Rochmanhadi, 1992). Tandem roller provides the same trajectory on each wheel. The following is the calculation of tandem roller productivity.

Production capacity,

$$Q = \frac{\{N\ x\ (b-bo)+bo\}\times v\times 1000\times Fa\times t}{N\times n}$$

Where:

V = Average tool speed
B = Effective compaction width
n = Number of passes
N = Pass lane
bo = Overlap width
Fa = Equipment efficiency factor
t = Layer thickness

h. Bar Cutter

Bar cutter functions to cut the reinforcing steel according to the planned length.

i. Bar Bender

Bar bender functions to make bends and links in reinforcement according to the plan.

F. Work Duration Calculation

Duration calculation of each work aims to estimate the time required to complete the work. The formula for work duration calculation can be seen as follows.

Table 4. Work Volume Recapitulation (Continued)

Work Description	Volume	Unit
Diaphragm casting	35,3	m^3
Formwork dismantling and repair	370,2	m^2
Concrete bridge deck slab Work		
Fabrication of deck slab reinforcement	34053,7	kg
Installation of deck slab reinforcement	34053,7	kg
Setting and installing deck slab formwork	61,1	m^2
Deck slab casting	224,3	m^3
Dismantling and repair of deck slab formwork	61,1	m^2
Steel bridge deck slab work		
Fabrication of deck slab reinforcement	21673,9	kg
Installation of deck slab reinforcement	21673,9	kg
Setting and installing deck slab formwork	34,8	m^2
Deck slab casting	144	m^3
Dismantling and repair of deck slab formwork	34,8	m^2
Parapet work		
Fabrication of parapet reinforcement	7459,4	kg
Installation of parapet reinforcement	7459,4	kg
Fabrication of parapet formwork	201,2	m^2
Installation of parapet formwork	201,2	m^2
Parapet casting	44,4	m^3
Dismantling and repair of parapet formwork	201,2	m^2
Sidewalk work		
Fabrication of sidewalk reinforcement	6149,6	kg
Installation of sidewalk reinforcement	6149,6	kg
Fabrication of sidewalk formwork	94,4	m^2
Installation of sidewalk formwork	94,4	m^2
Sidewalk casting	68,4	m^3
Dismantling and repair of sidewalk formwork	94,4	m^2
D. Pavement Structure Work		
Tack coat work		
Tack coat coating	806,9	ltr/m^2
Prime coat work		
Prime coat coating	114,8	ton
Scaffolding		
Scaffolding	958	set

$$\text{Work Duration} = \frac{\boldsymbol{Volume\ (m^3)}}{\boldsymbol{Work\ productivity\ (\frac{m^3}{jam})}}$$

G. *Time and Cost Management*

a. Network P*lanning*

Network planning is a network of activities that shows critical activities which require close supervision to avoid delays. One of the analysis methods in network planning is the Critical Path Method (CPM). CPM is a path that has a series of component activities with the longest total amount of time and shows the fastest project completion period.

b. Bar Chart

Bar chart is a bar chart or block chart where activities or works are placed in vertical pillars and time is placed in horizontal rows. Bar chart itself also presents the labor requirements, schedule, and material input requirements and schedule.

c. S-Curve

S-curve shows the project progress based on activities, time, and work weight displayed graphically to determine the cumulative percentage of all project activities against the planned schedule. In addition, S-curve also functions to determine the expenditure and cost requirements for project implementation and control deviations that occur in the project. From this graph, it can be seen whether there is a delay or acceleration of the project schedule. These indications can be the initial information to take corrective action in the schedule control process.

Table 5. Work Volume Recapitulation

No	Work Description	TOTAL COSTS
1	Preparatory Work	IDR 269.932.041
2	Substructure Work	
2.1	Bore Pile Work	IDR 1.377.588.669
2.2	Working Floor Work	IDR 79.198.134
2.3	Pile Cap Work	IDR 2.595.740.692
2.4	Pillar Work	IDR 1.690.290.693
2.5	Embankment Work	IDR 13.306.555
2.6	Pier Head Work	IDR 1.830.750.235
2.7	Abutment Work	IDR 605.016.273
2.8	Wing Wall work	IDR 332.355.251
2.9	Stepping Plate Work	IDR 142.188.337
3	Superstructure Work	
3.1	Mortar Pad Work	IDR 22.545.520
3.2	Bearing Pad Work	IDR 199.873.094
3.3	Stressing PCI Girder Work	IDR 303.833.142
3.4	Erection PCI Girder Work	IDR 5.303.521.844
3.5	Truss Bridge Erection	IDR 4.707.601.999
3.6	Diaphragm Work	IDR 183.902.119
3.7	Concrete Bridge Deck Slab Work	IDR 1.296.828.258
3.8	Steel Bridge Deck Slab Work	IDR 584.328.349
3.9	Parapet work	IDR 247.400.352
3.10	Sidewalk Work	IDR 248.856.801
4	Pavement Structure Work	
4.1	Tack Coat Work	IDR 18.214.760
4.2	AC-WC Coating Work	IDR 191.723.467
5	Scaffolding	IDR 67.362.833
	Total = Cost + Overhead + K3 + PPN	IDR 22.312.359.417

H. *Cost Budget Plan*

A cost budget plan is an effort to assess and estimate a development activity during the construction process. It also aims as a guideline as the basis for calculating cash flow, finding weights in making work schedules, and weighting work progress as a basis for installment payments. Cost budget calculation is influenced by the materials used, labor, equipment, overhead equipment, and profit [1]. The cost calculation formula used in this final project can be seen as follows.

a. Material Costs
   Volume x Material Prices
b. Labor Costs
   Duration x Number of Labors x Labor Wages
c. Equipment Costs
d. Duration x Number of Equipment x Rental Price

I. *Occupational Health and Safety*

Based on the Ministry of Public Works Regulation No.10 of 2021 [2], construction safety and health are all engineering activities to support construction work in realizing the fulfillment of security, safety, and health standards. Hazard identification, risk assessment, and risk control determination are steps in identifying hazards in construction work. Here are some examples of OHS management applications that applied to the project.

1. Everyone involved in the project should be introduced to occupational safety and health before construction work begins through an OHS (K3) induction.
2. It should explain the sequence of work and the potentials that can cause work accidents, whether equipment, materials, or work methods at the initial stage and the toolbox meeting/pre-start meeting. It is outlined in detail in the Job Safety Analysis (JSA).
3. Everyone involved in the work must wear personal

No	Uraian Pekerjaan	TOTAL BIAYA	DURASI	2021																										
				Juni				Juli				Agustus					September				Oktober					November				Des
1	**Pekerjaan Persiapan**			06-Jun	13-Jun	20-Jun	27-Jun	04-Jul	11-Jul	18-Jul	25-Jul	01-Aug	08-Aug	15-Aug	22-Aug	29-Aug	05-Sep	12-Sep	19-Sep	26-Sep	03-Oct	10-Oct	17-Oct	24-Oct	31-Oct	07-Nov	14-Nov	21-Nov	28-Nov	05-Dec
1.1	Pembersihan lahan	Rp167.509.510	9	0,5004984	0,2502492																									
1.2	Pekerjaan timbunan	Rp75.495.401	5		0,2030141	0,1353427																								
1.3	Pekerjaan galian struktur	Rp26.927.129	2					0,1206826																						
2	**Pekerjaan Struktur Bawah**																													
2.1	Pekerjaan Bore Pile	Rp1.377.588.669	22		3,346189	0,7176973	1,3558779	0,7543415																						
2.2	Pekerjaan Lantai Kerja	Rp79.198.134	5					0,0474109	0,3075409																					
2.3	Pekerjaan Pilecap	Rp2.595.740.692	16			3,117025	3,1302778		0,0265056	4,6332901	0,0304932																			
2.4	Pekerjaan Pilar	Rp1.690.290.693	19			2,158242	1,079121	3,237363		0,040893	0,3976139	0,6269064																		
2.5	Pekerjaan Timbunan	Rp13.306.555	1								0,0596376																			
2.6	Pekerjaan Pierhead	Rp1.830.750.235	28				3,0450603	2,0300402				1,0779396	0,066264	0,7977409	1,1728032	0,0152466														
2.7	Pekerjaan Abutment	Rp605.016.273	14									2,1238872	0,5826052	0,0050822																
2.8	Pekerjaan Wingwall	Rp332.355.251	10									1,3421058	0,1451053	0,0023456																
2.9	Pekerjaan Plat injak	Rp142.188.337	5										0,4164275	0,2173168	0,0035184															
3	**Pekerjaan Struktur Atas**																													
3.1	Pekerjaan mortar pad	Rp22.545.520	4												0,0996376	0,0014074														
3.2	Pekerjaan bearing pad	Rp199.873.094	1													0,8957954														
3.3	Pekerjaan Stressing Girder	Rp303.833.142	10												0,1361726	0,8170354	0,4085177													
3.3	Pekerjaan Erection PCI Girder	Rp5.303.521.844	9														7,9231451	7,9231451	7,9231451											
3.4	Erection Jembatan Rangka	Rp4.707.601.999	28																			4,5211348	4,5211348	4,5211348	4,5211348	3,7676124				
3.5	Pekerjaan Diafragma	Rp183.902.119	13											0,1443607	0,4053514				0,2604305	0,0140738										
3.6	Pekerjaan Deckslab Jembatan Beton	Rp1.296.828.258	15												1,353016	2,706032			0,0132528	0,598044	1,1418073									
3.7	Pekerjaan Deckslab Jembatan Baja	Rp584.328.349	9																	0,7966984	0,7966984					0,0132528	1,008687	0,0035184		
3.8	Pekerjaan Parapet	Rp247.400.352	14																								0,8100895	0,06169	0,3555368	
3.8	Pekerjaan Trotoar	Rp248.856.801	13																								0,4774803	0,4448801	0,358030	
4	**Pekerjaan Struktur Perkerasan**																													
4.1	Pekerjaan Lapisan Tack Coat	Rp18.214.760	1																											0,0816353
4.2	Pekerjaan Lapisan AC-WC	Rp191.723.467	1																											0,8592703
5	**Scaffolding**	Rp67.362.833	34																											
	Total	**Rp22.312.359.417**									0,0355186	0,0532779	0,0532779	0,0532779	0,0532779	0,0532779														
	Progres Mingguan (%)			0,5005	3,7995	6,1283	8,6103	6,1898	0,3340	4,6742	0,4877	5,1708	1,2104	1,1668	3,1705	4,4355	8,3317	7,9231	8,1968	1,4088	1,9385	4,5211	4,5211	4,5211	4,5211	3,7809	2,2963	0,5101	0,7136	0,9409
	Progress Kumulatif (%)			0,50	4,30	10,43	19,04	25,23	25,56	30,24	30,72	35,90	37,11	38,27	41,44	45,88	54,21	62,13	70,33	71,74	73,68	78,20	82,72	87,24	91,76	95,54	97,84	98,35	99,06	100

Figure 2. S-Curve

protective equipment while in the project area. Occupational health and safety signs are always placed in appropriate locations.

4. Mechanical and safety officers must always periodically check the equipment that is being used, and that will be used in the construction process.
5. Things need to be considered.
   a. Material placement
   b. Transportation access inspection
   c. Special attention is paid to chemical materials and given special marks
   d. Every supporting material must have an MSDS
6. Work protective equipment that must be used.
   a. Helmet
   b. Safety shoes
   c. Safety glove
   d. Mask
   e. Full Body Harness

METHODOLOGY

This methodology uses a flow chart as shown in Figure 1.

RESULTS AND DISCUSSION

A. *Work Volume*

Based on the volume calculation formula, the volume recapitulation is obtained as shown in Table 4.

B. *Time and Cost Calculation*

Based on the volume calculation, productivity calculations were carried out to obtain the total duration of each work item. The next stage was the work cost calculation by considering the resource requirements, labor requirements, and production capacity of the equipment used. The resources required for cost calculation were the materials used, the number of heavy equipment used, and the number of workers consisting of foremen, builders, labors, and heavy equipment operators.

Work schedule was carried out using the critical method or CPM with the Microsoft project software program. The result of the construction cost calculation added overhead (15%), k3 (2.5%), and ppn (11%). The following is a recapitulation of work time and cost calculations on the construction of the Watu Sewu Bridge.

C. *S-Curve*

Curve aimed to show the relationship between the cost cumulative value or percentage of work against time. In addition, S-Curve was a graph depicting the progress of the work volume completed. S-Curve was also useful as a scheduling control and project development. The following is the scheduling of the construction of the Watu Sewu Bridge.

CONCLUSIONS

Based on the analysis of implementation time and cost calculation on the Watu Sewu Bridge construction project, the conclusion can be obtained as follows.

1. The implementation time of the Watu Sewu Bridge construction project can be completed in 154 working days. The working assumption is effective working hours of 6 days with 7 hours of work per day and 1 hour of rest, namely 08.00 – 16.00 and breaks at 12.00-13.00, off on Sunday.
2. The implementation cost required in the Watu Sewu Bridge construction project from material costs, worker wage costs, and equipment costs was IDR 19.610.950.927. The cost included 15% overhead costs.
3. The total cost of the Watu Sewu Bridge construction project after considering K3 costs (2.5%) was IDR 20.101.224.700. After calculating with the addition of 11% VAT, the final value of the Watu Sewu Bridge construction project was IDR 22.312.359.417. The following is a detailed cost recapitulation of the Watu Sewu Bridge construction.

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