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# ANALYSIS OF CINAPEL BRIDGE PROJECT CONSTRUCTION MANAGEMENT ON THE CISUNDAWU TOLL ROAD

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## ABSTRACT

Construction management is an attempt to use limited resources efficiently, effectively and timly in completing a project that has been palnned. There are 3 kinds of basic functions of construction management including planning, implementation, and control. Of three of these activities to control the resources on aproject that includes worker, equipment, material, money, and method.

The research method used was qualitative research, as a way of collecting data on the study is how the study of the literature, interviews and direct observation in field. And this method is a method that is done to get a foundation theory in analyzing data, namely the analysis calculation of the volume of material, analysis of labor, analysis tool, method, method of Bar Chart S Curve and Critical Path Method.

The location of the studies reviewed were Analysis Of Cinapel Bridge Project Construction Management On The Toll Cisundawu Road , located on Pamatutan Hamlet Mulyasari – Pasir Hamlet Margamukti, Sumedang. The results of this research is the budget plan costs completed the construction of the Cinapel Bridge Project on Cisundawu Toll Road until the final stage costs less than Rp. 168,020,632,320, - and analysis of the Critical Path Method (CPM) estimates that the completion of the Cinapel Bridge on Cisundawu Toll Road takes 129 weeks (903 days)

**Keywords**: Construction Management, Bar Chart, S Curve, Critical Path Method

# 1. INTRODUCTION

## 1.1 BACKGROUND

Theavailability of existing infrastructure facilities in Indonesia is increasing, so that infrastructure can be considered as important community capital. One of the infrastructure developments currently being developed is the construction of bridges that are on the toll road.

The Cinapel Bridge on the Cisumdawu Toll Road, is one of the bridge projects on the toll road that crosses the Cileunyi - Sumedang and Cirebon Dawuan area. This road is a continuation of the planned toll road from the south that connects the Cikampek - Purwakarta - Padalarang - and Cileunyi toll roads, which will later ful fill the toll road from the north of Cikampek - Palimanan Cirebon in the Dawuan area.

## 1.2 FOCUS OF PROBLEM

The construction management project is in work methods, cost estimates and the cinapel project development network method on the cisundawu toll road.

## 1.3 SCOPE OF PROBLEM

So this is not too extensive research review of and not deviate from the specified formulation of the problem, it is necessary to need for restriction on the issue under review. Limits the problem taken in this study are as follows:

1. Review and retrieval of data in the form of shop drawings.
2. Determine the volume of the building.
3. Calculate budget plan work.
4. Methods of the analysis networking used in the research project is Critical Path Method (CPM), the use of Bar Chart and S-Curve.

## 1.4 PURPOSE OF RESEARCH

The purpose of research in development projects on the Cisumdawu Toll Road is as follows:

1. For analyze how the methods work on the construction of the Cinapel Bridge on the Cisumdawu Toll Road.
2. To determine the cost of building construction the Cinapel Bridge on the Cisumdawu Toll Road.
3. To know the methods of analysis Bar chart, CPM, S-Curve and the need for equipment, materials and man power.
4. To determine the duration of the construction work on the Cisumdawu Toll Road.

## 1.5 USEFULNESS OF RESEARCH

1. Theoretical Uses
   - As reference materials research on project management.
   - Add the mindset of student in learning, observation and understanding the problems related to the field of civil engineering.

2. Practical Usefulness
   - Know the process of preparation of project implementation schedule due to delays in the implementation of the field (Re-Schedule).
   - Add to the understanding of knowledge management and project implementation directly determine the calculation of the volume of work.

### 1.6 USEFULNESS OF RESEARCH

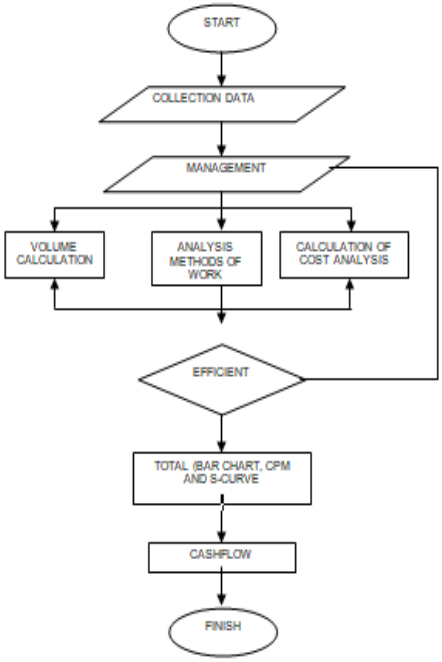



**Figure 1.** Framework

### 1.7 WRITING OF SYSTEMATIC

CHAPTER I INTRODUCTION

Contains background, focus the problem, scope of problem, purpose of research, usefulness of research and framework of thought and systematics of writing.

CHAPTER II LITERATURE REVIEWS AND BASIS THEORY

Contains about similar research that ever existed from books, journals and electronic media (internet)

CHAPTER III RESEARCH METHODOLOGY

Contains data collection methods, data types and sources, data collection techniques, research objects and locations and research schedules.

CHAPTER IV ANALYSIS AND DISCUSSION

Contains the results of research that has been done by observing directly and discussed the solution that will be done in this research.

CHAPTER V CONCLUSIONS AND SUGGESTIONS

Contains the conclusions of the research results in accordance with the focus of problems and suggestions applicative. Each statement of conclusions should be supported by the results of the analysis illustrated in the previous chapter. Similarly, written suggestions should be based on analysis statements, studies and conclusions.

## 2. LITERATURE REVIEW AND BASIC THEORY

### 2.1 LITERATURE REVIEW

The literature review is collecting scientific data and information to serve as the foundation of research, in the form of theories, findings, methods or approaches that developed and have been documented in the form of books, journals, manuscripts, records, historical recordings, documents and others. The literature review helps us in getting an idea of a topic to be considered in terms of what previous researchers have done.

#### 2.1.1 PREVIOUS RESEARCH

First, research conducted Lyta Pratama Arif (2013) under the title **" Pengembangan Model Analisa Manajemen Konstruksi Proyek Pembangunan Waduk"**. Objective namely to analyze Job Barries, Analyze Job Implementation, Project Delay In Project Implementation of Jati Gede Reservoir.

Second Research conducted by Saripudin (2014) with the title of the research "**Analilis Manajemen Pelaksanaan Proyek Hotel Grand Prima Cirebon**". The goal is to set the schedule of work to plan the progress of work and maintenance on the structure of the building by using data analysis methof of CPM (*Critical Path Method*) as a corrective action to analyze the work network for the implementation of the project to be deal.

Third, Research conducted by Itan Faizar (2015) with by title "**Analisis Manajemen Konstruksi Proyek Rumah Sakit ArjawinangunKabupaten Cirebon"**. The objective is ro re-design volume calculation, time schedule, cost and method of implementation..

### 2.1.2 DIFFERENCES WITH THE PREVIOUS RESEARCH

The current study is the management Design of Cinapel Bridge Construction on Cisumdawu Toll Roal. Basically, it has the same element of similarity with previous research when viewed from the aspect of its goal is to overcome problems in project management such as arranging implementation, and schedule for preparation for implementation.

The same method as CPM, Grant Chart and S-Curve will be used as an analytical method in this thesis but there are slight differences in the types of project construction, so the implementation or method of implementing the design will be different.

## 2.2 BASIC THEORY

### 2.2.1 MANAGEMENT

From several sources, collected definitions from several experts who put Management (Stephen P Robbins, 2007) is the process of coordinating work activities so that the work is completed efficiently and effectively and through other people. Management involves the efficiency and effectiveness of the completion of organizational work activities. Efficiency refers to obtaining the largest output with the smallest input, because of the scarce resources like people, money and equipment. Efficiency is described as "doing everything right" means not wasting resources. However, it is not enough just to be efficient management also focuses on effectiveness. Effectiveness is usually defined as completing activities so that organizational goals can be achieved. Effectiveness is often described as doing everything right from the way and its resources.

### 2.2.2 PROJECT MANAGEMENT

Project management (Heizer and Render, 2006) is a way of applying science, skills, tools, and techniques to the activities of a project to meet and exceed what is needed by stakeholders of a project. included in the stakeholder group of a project are all people involved or influenced by the activities of a project, including sponsors, teams, support staff, customers, suppliers, even people who are competitors. Meanwhile, according to Budi Sentosa, project management is an activity of planning, coordinating, directing, and controlling certain resources. Project management can also be interpreted as (Budi Santosa, 2003) an activity process for planning, organizing, directing and controlling certain resources. Project management has several advantages (Heizer and Render, 2006) as follows:

1. Increased relationships with customers
2. Better control than HR, financial and physical fields
3. Shorter development time
4. Higher quality and increased reliability
5. Lower costs and greater profits
6. Better coordination and increased productivity
7. Working capital is better

## 2.3 DATA ANALYSIS METHOD

This study uses several methods used to manage the time and resources used in the project: Bar Chart method, s-curve method and Critical Path Method and Cash Flow.

### A. Bar Chart

The bar chart is a graph with a rectangle. Any length or height of a bar is proportional to the values represented by a bar. In other words, the length or height of the bar is equal to the quantity in that category. Graphs usually show comparisons between different categories. Although charts can technically be plotted vertically or horizontally, the most common presentation for bar graphs is vertical. The x-axis represents the category; The y-axis represents the value for that category. In the graph below, the value is a percentage.

A bar chart is a set of events placed in a vertical column that is temporarily placed on a horizontal row. The start and finish time of each activity along with its duration is displayed with the horizontal beam to the right of each

activity. Estimated start and end times can be determined from the horizontal time scale at the top of the graph. Block length indicates the duration of activity and is usually set in chronological work activities. (Callahan, 1992)

**B. S Curve**

S-curves are graphs created with the vertical axis as the cumulative value of cost or progress of activity and the horizontal axis as time (Suharto, 1997). Another definition, the S-curve is the result of the barcharts plot, which aims to facilitate the viewing of activities included in the period of observation of the progress of project implementation (Callan, 1992). S-curve can show project capability based on activity, time and workload represented as a cumulative percentage of all project activities.

The s-curve visualization provides information about the progress of the project by comparing the schedule with the plan. (Husen, 2011).

**.C. Critical Path Method**

According to CPM or critical path method is a path that has a range of activity components with the longest total number of times and shows the fastest project completion period. Thus, the critical path consists of a series of critical activities, starting from the first activity to the final project activity. The significance of the critical path is important to the project implementer, since this pathway lies the activities which, if delayed, will result in the overall project delays. Soeharto (1999).

Sometimes it can be found more than one critical path in the network. Before creating a critical path in the network scheduling method of Activity on Arrow (AOA), it must first be known how to calculate the duration of a project divided into counts forward and countdown.

**D. Cash Flow**

Cash flow is a product of planning among other planning products in construction planning, such as scheduling, construction methods and implementation budget (Asiyanto, 2005). Cash flow will generate outflows of money during construction project implementation and also as a tool to forecast future financial condition.

## 3. RESEARCH METHODS

### 3.1. RESEARCH METHODS

The preparation of this task will use qualitative research methods, with this data collection carried out by observation, interviews and literature studies on all work related to the Cinapel Bridge project on Cisundawu Toll Road.

### 3.2. WRITING METHODS

The method of planning method begins with collecting and studying literature related to construction management. Collect field data that will be used as data in the object. The methods used in this paper are as follows :

a Study the literature by gathering references and methods needed as literature review from books and other media (internet)
b Data processing and analysis is obtained
c Take conclusions and suggestions from the results of the study

### 3.3. TYPE AND SOURCE OF DATA

The data source is anything that can provide information about the data. By type, the data are divided into two, namely primary and secondary data.

Primary data is data made by the researcher for the specific purpose of solving the problem being handled. The data is collected by the researcher directly from the first source or place of the research object is done.

Secondary data is data that has been collected for purposes other than solve the problem being faced. This data can be found quickly. In this study the secondary data sources are literature, articles, journals and internet sites related to research conducted.

### 3.4. TECHNIQUE AND DATA COLLECTION

In preparing this thesis, data is obtained in three ways

1. Observation

Observations are made by observing work or activities carried out at the project location, and reading and copying data related to implementation for analysis purposes.

2. Interview

Interviews are conducted with project actors or stakeholders including the field section and the planning (office) section

3. Literature Study

Literature study is done by collecting references related to the implementation of similar project management, by comparing and drawing conclusions, to support the process of preparing this thesis.

### 3.5. RESEARCH TIME

The time required in this study from Febuary to April 2019, approximately 3 months.

### 3.6. RESEARCH IN SURANCE

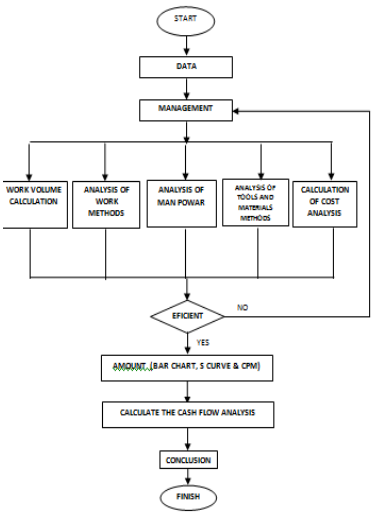



**Figure 2.** Line Method

### 3.7. DATA ANALYSIS METHOD

In the preparation of this thesis there are 2 types of data described in the previous section. Data will be analyzed by several methods, first the data is analyzed to determine the network, then some data are analyzed to get the cost and time for effective and efficient project implementation. Some of these methods are, CPM (Critical Path Method), Chart Bar, S-Curve.

### 3.8. RESEARCH LOCATION

For research conducted on the Cinapel Bridge Project located on the CISUMDAWU Toll Road, the following is a map of the location of the Cinapel Bridge Project and project plan profile:

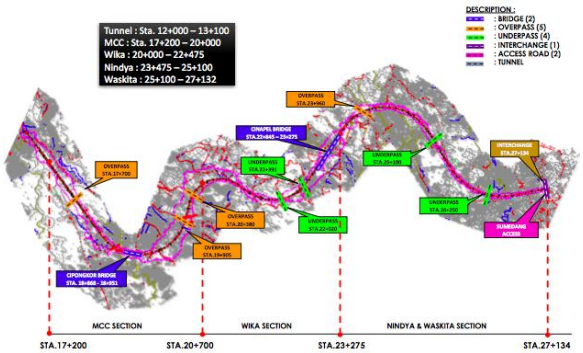



**Figure 3.** Project Located

## 4. RESEARCH RESULT AND DISCUSSION

### 4.1 GENERAL DESCRIPTION OF THE PROJECT

The construction of the Cinapel bridge is one of the development works in the CISUMDAWU Toll Road Construction Project. The objectives of the CISUMDAWU Toll Road Development Project are :

- Integrate Bandung and Cirebon City with the planning of West Java International Airport (BIJB) in Majalengka and Cirebon Port as the entrance to West Java Province.
- Increasing economic growth around the Toll Road.
- Encouraging the development of the Province from the East of West Java Province which is relatively less developed compared to the West.
- As an alternative to Prince Cadas road.

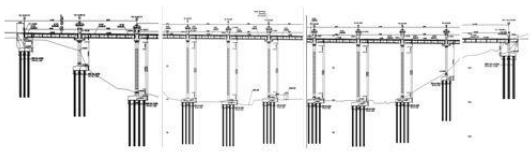


**Figure 4.**

## 4.2 GENERAL PROJECT DATA

| | |
|---|---|
| Name | : Counstruction of Cinapel Bridge on Cisumdawu Toll Road Project Sumedang Regency |
| Project Address | : Pamatutan Hamlet, Mulyasari – Hamlet Pasir, Sumedang |
| Long | : 427,740 km |
| Wide | : 34,1 m |
| Types of Pavement | : Bore Pile |
| Number of Bore Pile | : 434 point |
| Foundation depth | : 25 M |
| Diameter Foundation | : 1,2 M |

## 4.3 DESCRIPTION OF WORK

a. Preparation Work
b. Land Excavation
c. Foundation
d. Structure
e. Finishing

## 4.4 METHOD OF IMPLEMENTATION WORK

What is meant by the volume of a job is to calculate the amount of work volume in one unit. Volume is also referred to as work cubication. So the volume or cubication of a job is not the actual volume or content but rather the volume of the work part in one unit. (H. Bachtiar Ibrahim, 2012)

Calculation of work volume is to calculate the amount of work volume in one unit, or volume is called cubication work which is part of the work in one unit. In this case the calculation of volume includes preparation, earthwork and foundation work. Calculation of the volume of bore pile foundation work on the construction of the Cinapel bridge on the CISUMDAWU toll road:

- Volume of soil Drilling

Formula : $(\pi\ x\ r^2)$ x T = … m³
Where : $\pi = 3{,}14$
r = Radius *bore pile* = $\frac{1}{2} x$ 1,2 = 0,6 m
T = soil drill height/ depth = 25 m
$(3{,}14\ x\ 0{,}6^2)$ x 25 = 28,26 m³
So the volume of bore pile drilling for 1 point is 28.26 m³. For the depth of each point at each Pier and Abutment, they have the same depth.

- Example of calculation of drilling on Abutment 1 point A1.

$(\pi\ x\ r^2)$ x T = … m³
$(3{,}14\ x\ 0{,}6^2)$ x 25 = 28,26 m³

- Structural excavation volume and transport to the disposal site (Disposal Area)

- *Abutment* 1 and *Abutment* 2

P x L x t
34,1 x 8,5 x 2 = 579 m³

- Pier 1 and Pier 9

P x L x t
33,5 x 9,7 x 2,5 = 812, 375 m³

- Pier 2 - Pier 8

P x L x t

- 33,5 x 13,3 x 2,5 = 1.113,875 m³

After excavation, the results of the excavation of the excavation area are carried out with a hauling distance of 1 km.

- Structure Volume

- Abutmen

Wall = L x W x H = 34.10 x 5.16 x 5.50 = 968 m³
Wing Wall = L x W = 34.68 x 5.93 x 2 = 94 m³
Head Wall = L x W x H = 34.10 x 5.50 x 2.55 = 478 m³
Results = 968 + 94 + 478 = 1539 m³

- Pier & Pier Head

Pier 1 = L x W x H x L x W = 13 x 3 x 2 x 25.60 x 112.67 = 216

- PC - I Girder (Not counted manually because it's already fabricated)
- Diafragma = L x W = 2.10 x 2 = 4 m³

- Volume Finishing

- RC Plat & Slab = L x W x H = 41.43 x 15.30 x 0.25 = 158 m³
- Aspalt ( A1-P1 & P9-A2 )= L x W x H =41.43 x 15.30 x 0.05 = 127 m³

**Table 1.** Volume of Work

4.2 VOLUME CALCULATIONS

Job : Cinapel Bridge
Project : Construction of the Cinapel Bridge on the Cisundawu Toll Road Project
Location : Panutan Hamlet, Mulyasari Village (A1) – Margamukt Village (A2) Sumedang Regerency.

| PAY ITEM | JOB DESCRIPTION | FORMULA | FORMULA L | FORMULA W | FORMULA H | FORMULA : | FORMULA C | | VOLUME | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | PREPARATORY WORK | | | | | | | | | |
| 1.1 | Mobilization and Demobilization | | | | | | | | | |
| 1.2 | Land Clearing | | | | | | | | | |
| | a. Abutment 1 & Abutment 2 | | 34.10 | 8.50 | | | 2.00 | | 580 | $m^2$ |
| | b. Pier 1 & Pier 9 | | 33.50 | 9.70 | | | 2.00 | | 650 | $m^2$ |
| | c. Pier 2 - Pier 8 | | 33.50 | 13.30 | | | 7.00 | | 3,199 | $m^2$ |
| | | | | | | | | Total | 4,249 | $m^2$ |
| 2 | Land Excavation Work | | | | | | | | | |
| | a. Abutment 1 & Abutment 2 | L x W x H | 34.10 | 8.50 | 2.00 | | 2.00 | | 1,159 | $m^3$ |
| | b. Pier 1 & Pier 9 | L x W x H | 33.50 | 9.70 | 2.50 | | 2.00 | | 1,625 | $m^3$ |
| | c. Pier 2 - Pier 8 | L x W x H | 33.50 | 13.30 | 2.50 | | 7.00 | | 7,797 | $m^3$ |
| | | | | | | | | Total | 10,581 | $m^3$ |
| 3 | Pekerjaan Pondasi | | | | | | | | | |
| 3.1 | Pekerjaan Bore Pile | ($\pi$xr$^2$xn) | | | | | | Jml BP | | |
| | a. Abutment 1 & Abutment 2 | | 3.14 | 0.36 | 25.00 | 28.26 | 2.00 | 30.00 | 1,696 | $m^3$ |
| | b. Pier 1 & Pier 9 | | 3.14 | 0.36 | 25.00 | 28.26 | 2.00 | 33.00 | 1,865 | $m^3$ |
| | c. Pier 2 - Pier 8 | | 3.14 | 0.36 | 25.00 | 28.26 | 7.00 | 44.00 | 8,704 | $m^3$ |
| | | | | | | | | Total | 12,265 | $m^3$ |
| 3.2 | Footing work | | L | x | b | H | | | | |
| | a. Abutment 1 & Abutment 2 | ((a+b)*H)/2 | 34.10 | 8.50 | 1.20 | 2.00 | 2.00 | | 662 | $m^3$ |
| | b. Pier 1 & Pier 9 | ((a+b)*H)/2 | 33.5 | 9.70 | 2.00 | 2.50 | 2.00 | | 900 | $m^3$ |
| | c. Pier 2 - Pier 8 | ((a+b)*H)/2 | 33.5 | 13.30 | 2.50 | 2.50 | 7.00 | | 4631 | $m^3$ |
| | | | | | | | | Total | 6273 | $m^3$ |
| 4 | Structural Work | | | | | | | | | |
| 4.1 | Abutment | | | | | | | | | |
| | Abutment 1 | | | | | | | | | |
| | Wall | L x W x H | 34.10 | 5.16 | 5.50 | | | | 968 | $m^3$ |
| | Wing Wall | L x W | 34.74 | 6.24 | 5.93 | | 2.00 | | 94 | $m^3$ |
| | Head Wall | L x W x H | 34.10 | 5.50 | 2.55 | | | | 478 | $m^3$ |
| | | | 102.94 | 16.90 | 13.97 | | | | 1539 | $m^3$ |
| | Abutment 2 | | | | | | | | 1539 | $m^3$ |
| | Wall | L x W x H | 34.10 | 5.16 | 5.50 | | | | 968 | $m^3$ |
| | Wing Wall | L x W | 34.68 | 6.24 | 5.93 | | 2.00 | | 94 | $m^3$ |
| | Head Wall | L x W x H | 34.10 | 5.50 | 2.55 | | | | 478 | $m^3$ |
| | | | | | | | | Total | 1539 | $m^3$ |
| 4.2 | pier | | | | | w. hollow | P (PH) | L (PH) | | |
| | a. P1 | L x W x H | 13.00 | 3.00 | 2.00 | | 25.60 | 112.67 | 216 | $m^3$ |
| | b. P2 | L x W x H | 29.50 | 3.50 | 2.50 | 81.94 | 25.60 | 112.67 | 393 | $m^3$ |
| | c. P3 | L x W x H | 34.00 | 3.50 | 2.50 | 100.31 | 25.60 | 112.67 | 434 | $m^3$ |
| | d. P4 | L x W x H | 35.00 | 3.50 | 2.50 | 104.06 | 25.60 | 112.67 | 445 | $m^3$ |

## 4.5 TIME AND COST PLANNING

In determining the activities that will be carried out to complete the construction work of the Cinapel bridge on the Cisumdawu toll road, it is necessary to pay attention to the factors that usually affect project implementation are weather or season, weather is identified from the survey results in the project location besides weather factors, factors formulated in time planning is a holiday or national holiday, if the project period has a holiday or national holiday, then the holiday is input into project planning.

## 4.6 COMPILATION OF PROJECT SCHEDULING

Before analyzing Barchart, the Critical Path Method, the s curve is needed to calculate the duration in advance to find out how many jobs need several days, require how many workers, and need how many tools to use.

**Table 2.** Time Schedule

4.3 DURATION

| PAY ITEM | DESCRIPTION | MAN POWER | COEFFICIENT MAN POWER | TOOL | PKA/ PRODUCTIVITY | P x HOUR | VOLUME OF WORK | UNIT | DURATION ( DAY ) | WEEK | AMOUNT OF WORKER AND TOOL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | PREPARATORY WORK | | | | | | | | | | |
| 1.1 | Mobilization dan Demobilization | | | | | | | | | | |
| 2 | Land Excavation | | | | | | | | | | |
| 2.1 | Land Clearing | | | | | | | | | | |
| | | | | Excavator | 120.00 | 960.00 | 4240 | $m^2$ | 5 | 1 | 1 |
| | | | | Buldozer | 205.04 | 1640.32 | | | 3 | 1 | 1 |
| | | | | Dumptruck | 66.90 | 535.20 | | | 8 | 1 | 1 |
| | | | | | | | | Total | 16 | 2 | |
| | a. Abutment 1 & Abutment 2 | | | Excavator | 120.00 | 960.00 | 1159 | $m^3$ | 12 | 1 | 1 |
| | | | | Buldozer | 205.04 | 1640.32 | | | 1 | 1 | 1 |
| | | | | Dumptruck | 66.90 | 535.20 | | | 3 | 1 | 1 |
| | | | | | | | | Total | 4 | 1 | |
| | b. Pier 1 & Pier 9 | | | Excavator | 120.00 | 960.00 | 1625 | $m^3$ | 2 | 1 | 1 |
| | | | | Dump Truck | 66.90 | 535.20 | | | 3 | 1 | 1 |
| | | | | Buldozer | 205.04 | 1640.32 | | | 1 | 1 | 1 |
| | | | | | | | | Total | 6 | 1 | |
| | c. Pier 2 - Pier 8 | | | | | | | | | | |
| | | | | Excavator | 120.00 | 960.00 | 7797 | $m^3$ | 2 | 0 | 1 |
| | | | | Dump Truck | 66.90 | 535.20 | | | 2 | 0 | 1 |
| | | | | Buldozer | 205.04 | 1640.32 | | | 1 | 0 | 1 |
| | | | | | | | | Total | 6 | 1 | |
| 3 | Foundation | | | | | | | | | | |
| 3.1 | Bore Pile's | | | | | | | | | | |
| | a. Abutment 1 & 2 | | | | | | | | | | |
| | Drilling | | | manin bor pile | 28.83 | 333.33 | 1696 | $m^3$ | 5.1 | 1 | 2 |
| | Reinforcement | Worker | 0.007 | | 142.86 | 19422.57 | 241760 | kg | 10.5 | 2 | 17 |
| | | Head Worker | 0.0007 | | 1420.57 | 45714.29 | | | 4.53 | 1 | 4 |
| | | Foreman | 0.0004 | | 2500.00 | 80000.00 | | | 10.56 | 2 | 1 |
| | Cutting | | | Truck Hitcher | 7.00 | 224.00 | 1696 | $m^3$ | 6 | 1 | 5 |
| | | | | | | | | Total | 37 | 5 | |
| | b. Pier 1 & Pier 9 | | | | | | | | | | |
| | Drilling | | | manin bor pile | 28.83 | 333.33 | 1865 | $m^3$ | 6 | 1 | 2 |
| | Reinforcement | Worker | 0.007 | | 142.86 | 17162.14 | 232945 | kg | 14 | 2 | 15 |
| | | Head Worker | 0.0007 | | 1420.57 | 45714.29 | | | 5.10 | 1 | 4 |
| | | Foreman | 0.0004 | | 2500.00 | 40000.00 | | | 5.82 | 1 | 2 |
| | Cutting | | | Truck Hitcher | 7.00 | 392.00 | 1865 | $m^3$ | 4.76 | 1.00 | 7 |
| | | | | | | | | Total | 38 | 9 | |
| | c. Pier 2 - Pier 8 | | | | | | | | | | |
| | Drilling | | | manin bor pile | 28.83 | 333.33 | 8704 | $m^3$ | 10 | 1 | 5 |
| | Reinforcement | Worker | 0.007 | | 142.86 | 22857.14 | 1661035.34 | kg | 31 | 4 | 20 |
| | | Head Worker | 0.0007 | | 1420.57 | 137142.86 | | | 5.10 | 1 | 12 |
| | | Foreman | 0.0004 | | 2500.00 | 120000.00 | | | 5.82 | 1 | 6 |
| | Cutting | | | Truck Hitcher | 7.00 | 1064.00 | 8704 | $m^3$ | 17.22 | 2 | 9 |
| | | | | | | | | Total | 69 | 10 | |
| 3.2 | Footing | | | | | | | | | | |
| | a. Abutment 1 & 2 | | | | | | | | | | |
| | Reinforcement | Worker | 0.007 | | 142.86 | 11420.57 | | | 9 | 1 | 10 |

## 4.7 BARCHART ANALYSIS

Based on the planning and results of the calculation, if you use the Barchart Method Analyst are as follows:

**Table 3.** Barchart Material

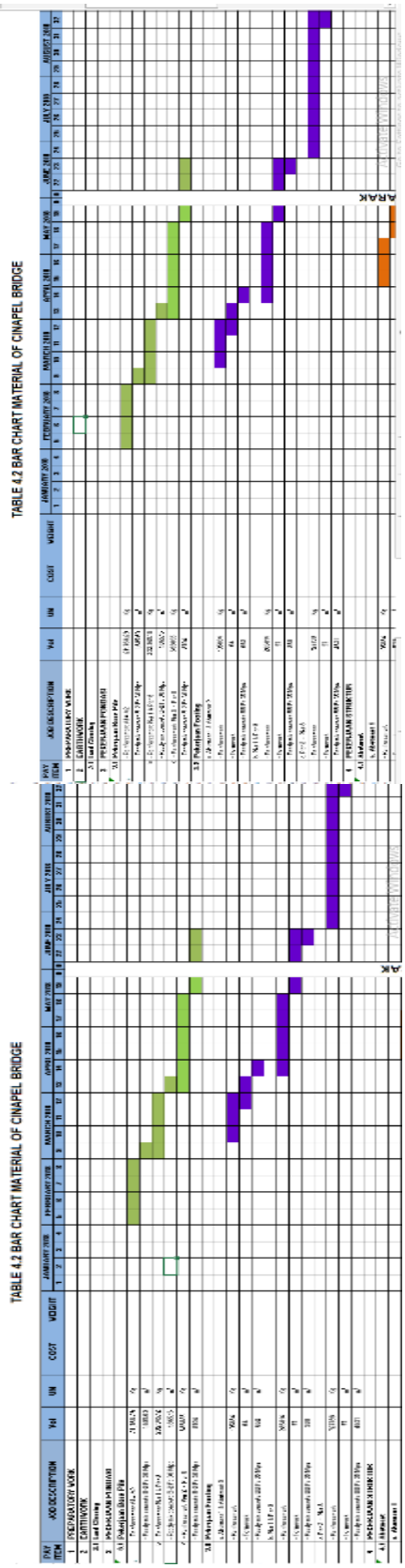


**Table 4.** Barchart Man Power

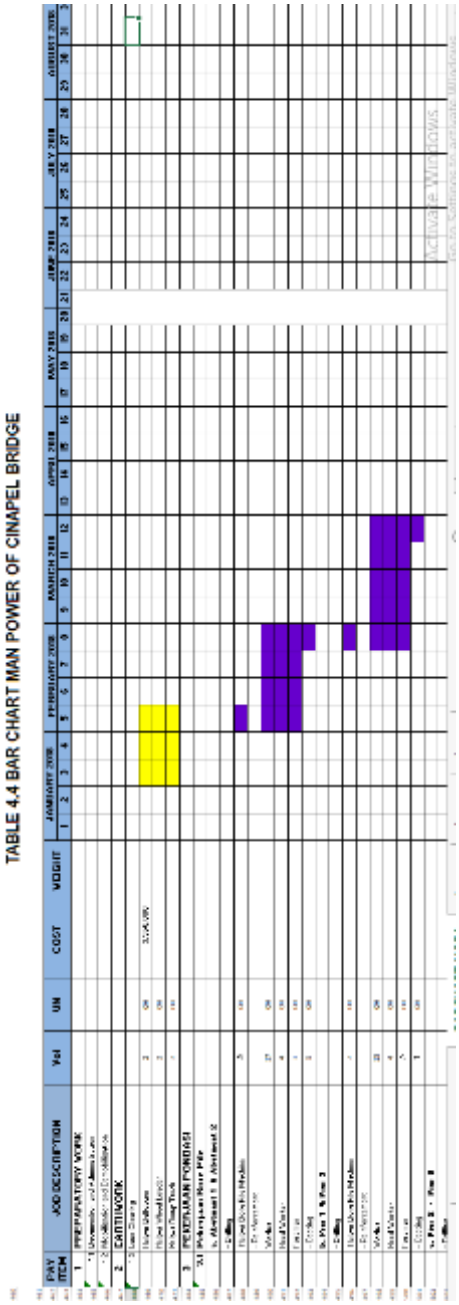
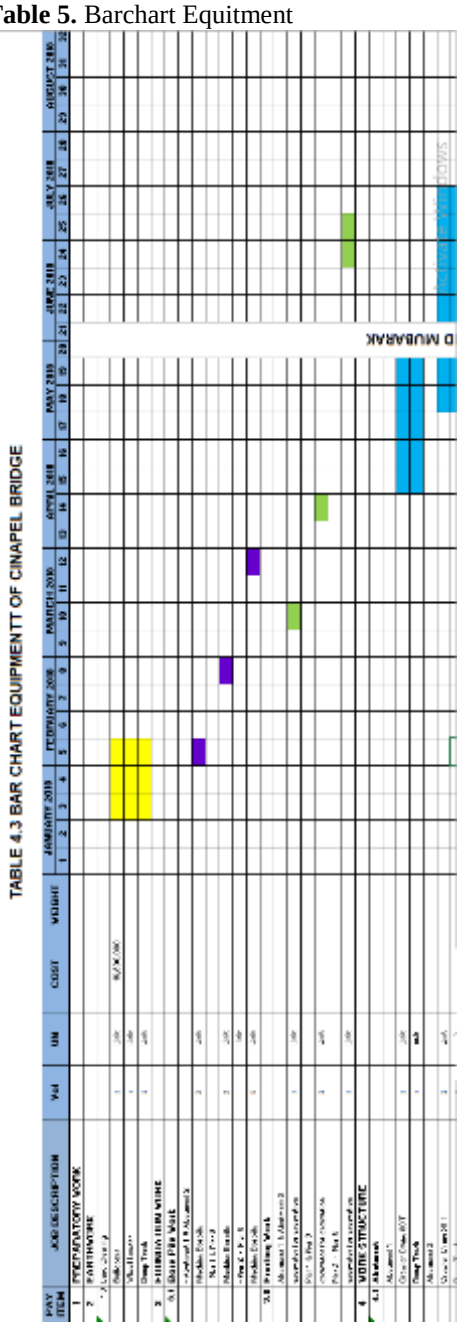



**Table 5.** Barchart Equitment




## 4.8. CASTFLOW CALCULATION

### PLANNING

Cashflow is an estimate of the flow of funds to be spent on project development in accordance with the time schedule prepared by the contractor. The making of cashflow is usually used at the beginning of the presentation with the owner because it aims to arrange the finances of the owner about the amount of expenditure each week.

**Table 6.** Cast Flow Material

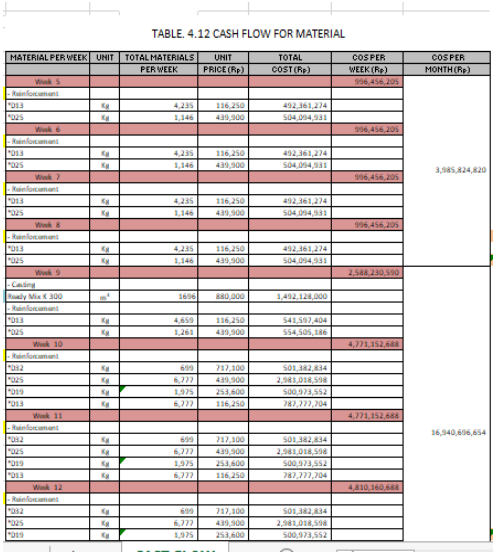


TABLE. 4.12 CASH FLOW FOR MATERIAL

| MATERIAL PER WEEK | UNIT | TOTAL MATERIALS PER WEEK | UNIT PRICE (Rp) | TOTAL COST (Rp) | COS PER WEEK (Rp) | COS PER MONTH (Rp) |
|---|---|---|---|---|---|---|
| Week 5 | | | | | 996,456,205 | |
| - Reinforcement | | | | | | |
| D13 | Kg | 4,235 | 116,250 | 492,361,274 | | |
| D25 | Kg | 1,146 | 439,900 | 504,094,931 | | |
| Week 6 | | | | | 996,456,205 | |
| - Reinforcement | | | | | | |
| D13 | Kg | 4,235 | 116,250 | 492,361,274 | | |
| D25 | Kg | 1,146 | 439,900 | 504,094,931 | | 3,985,824,820 |
| Week 7 | | | | | 996,456,205 | |
| - Reinforcement | | | | | | |
| D13 | Kg | 4,235 | 116,250 | 492,361,274 | | |
| D25 | Kg | 1,146 | 439,900 | 504,094,931 | | |
| Week 8 | | | | | 996,456,205 | |
| - Reinforcement | | | | | | |
| D13 | Kg | 4,235 | 116,250 | 492,361,274 | | |
| D25 | Kg | 1,146 | 439,900 | 504,094,931 | | |
| Week 9 | | | | | 2,588,230,590 | |
| - Casting | | | | | | |
| Ready Mix K 300 | $m^3$ | 1696 | 880,000 | 1,492,128,000 | | |
| - Reinforcement | | | | | | |
| D13 | Kg | 4,659 | 116,250 | 541,597,404 | | |
| D25 | Kg | 1,263 | 439,900 | 554,505,186 | | |
| Week 10 | | | | | 4,771,152,688 | |
| - Reinforcement | | | | | | |
| D32 | Kg | 699 | 717,100 | 501,382,834 | | |
| D25 | Kg | 6,777 | 439,900 | 2,981,018,598 | | |
| D19 | Kg | 1,975 | 253,600 | 500,973,552 | | |
| D13 | Kg | 6,777 | 116,250 | 787,777,704 | | |
| Week 11 | | | | | 4,771,152,688 | |
| - Reinforcement | | | | | | 16,940,696,854 |
| D32 | Kg | 699 | 717,100 | 501,382,834 | | |
| D25 | Kg | 6,777 | 439,900 | 2,981,018,598 | | |
| D19 | Kg | 1,975 | 253,600 | 500,973,552 | | |
| D13 | Kg | 6,777 | 116,250 | 787,777,704 | | |
| Week 12 | | | | | 4,810,160,688 | |
| - Reinforcement | | | | | | |
| D32 | Kg | 699 | 717,100 | 501,382,834 | | |
| D25 | Kg | 6,777 | 439,900 | 2,981,018,598 | | |
| D19 | Kg | 1,975 | 253,600 | 500,973,552 | | |

**Table 7.** Cast Flow Equitment

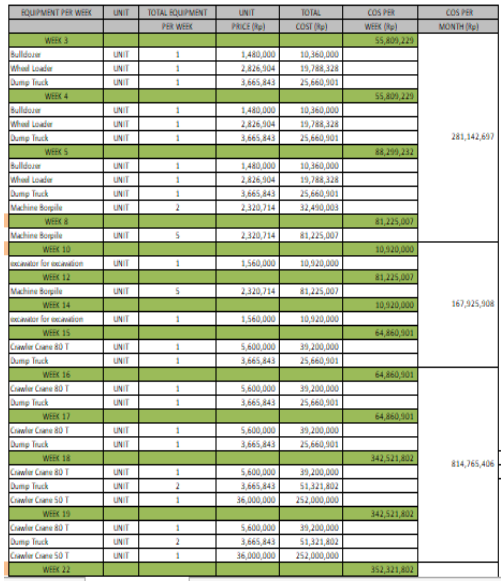


TABLE. 4.13 CASH FLOW FOR EQUIPMENT

| EQUIPMENT PER WEEK | UNIT | TOTAL EQUIPMENT PER WEEK | UNIT PRICE (Rp) | TOTAL COST (Rp) | COS PER WEEK (Rp) | COS PER MONTH (Rp) |
|---|---|---|---|---|---|---|
| WEEK 3 | | | | | 55,809,229 | |
| Bulldozer | UNIT | 1 | 1,480,000 | 10,360,000 | | |
| Wheel Loader | UNIT | 1 | 2,826,904 | 19,788,328 | | |
| Dump Truck | UNIT | 1 | 3,665,843 | 25,660,901 | | |
| WEEK 4 | | | | | 55,809,229 | |
| Bulldozer | UNIT | 1 | 1,480,000 | 10,360,000 | | |
| Wheel Loader | UNIT | 1 | 2,826,904 | 19,788,328 | | |
| Dump Truck | UNIT | 1 | 3,665,843 | 25,660,901 | | 281,142,697 |
| WEEK 5 | | | | | 88,299,232 | |
| Bulldozer | UNIT | 1 | 1,480,000 | 10,360,000 | | |
| Wheel Loader | UNIT | 1 | 2,826,904 | 19,788,328 | | |
| Dump Truck | UNIT | 1 | 3,665,843 | 25,660,901 | | |
| Machine Borpile | UNIT | 2 | 2,320,714 | 32,490,003 | | |
| WEEK 8 | | | | | 81,225,007 | |
| Machine Borpile | UNIT | 5 | 2,320,714 | 81,225,007 | | |
| WEEK 10 | | | | | 10,920,000 | |
| excavator for excavation | UNIT | 1 | 1,560,000 | 10,920,000 | | |
| WEEK 12 | | | | | 81,225,007 | |
| Machine Borpile | UNIT | 5 | 2,320,714 | 81,225,007 | | |
| WEEK 14 | | | | | 10,920,000 | 167,925,908 |
| excavator for excavation | UNIT | 1 | 1,560,000 | 10,920,000 | | |
| WEEK 15 | | | | | 64,860,901 | |
| Crawler Crane 80 T | UNIT | 1 | 5,600,000 | 39,200,000 | | |
| Dump Truck | UNIT | 1 | 3,665,843 | 25,660,901 | | |
| WEEK 16 | | | | | 64,860,901 | |
| Crawler Crane 80 T | UNIT | 1 | 5,600,000 | 39,200,000 | | |
| Dump Truck | UNIT | 1 | 3,665,843 | 25,660,901 | | |
| WEEK 17 | | | | | 64,860,901 | |
| Crawler Crane 80 T | UNIT | 1 | 5,600,000 | 39,200,000 | | |
| Dump Truck | UNIT | 1 | 3,665,843 | 25,660,901 | | |
| WEEK 18 | | | | | 342,521,802 | |
| Crawler Crane 80 T | UNIT | 1 | 5,600,000 | 39,200,000 | | 814,765,406 |
| Dump Truck | UNIT | 2 | 3,665,843 | 51,321,802 | | |
| Crawler Crane 50 T | UNIT | 1 | 36,000,000 | 252,000,000 | | |
| WEEK 19 | | | | | 342,521,802 | |
| Crawler Crane 80 T | UNIT | 1 | 5,600,000 | 39,200,000 | | |
| Dump Truck | UNIT | 2 | 3,665,843 | 51,321,802 | | |
| Crawler Crane 50 T | UNIT | 1 | 36,000,000 | 252,000,000 | | |
| WEEK 22 | | | | | 352,321,802 | |

**Table 8.** Cast Flow For Labor

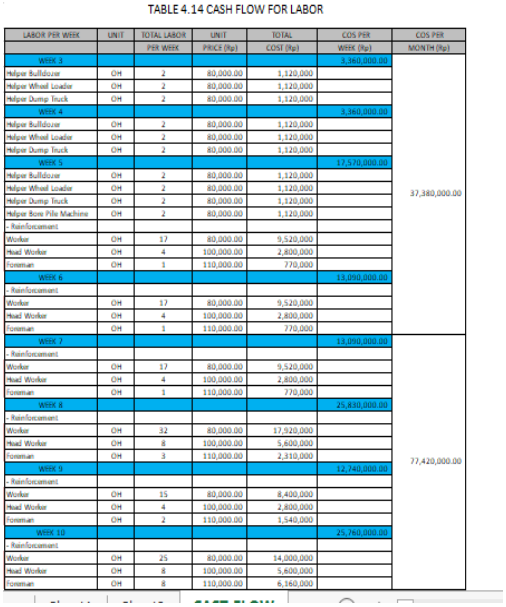


TABLE 4.14 CASH FLOW FOR LABOR

| LABOR PER WEEK | UNIT | TOTAL LABOR PER WEEK | UNIT PRICE (Rp) | TOTAL COST (Rp) | COS PER WEEK (Rp) | COS PER MONTH (Rp) |
|---|---|---|---|---|---|---|
| WEEK 3 | | | | | 3,360,000.00 | |
| Helper Bulldozer | OH | 2 | 80,000.00 | 1,120,000 | | |
| Helper Wheel Loader | OH | 2 | 80,000.00 | 1,120,000 | | |
| Helper Dump Truck | OH | 2 | 80,000.00 | 1,120,000 | | |
| WEEK 4 | | | | | 3,360,000.00 | |
| Helper Bulldozer | OH | 2 | 80,000.00 | 1,120,000 | | |
| Helper Wheel Loader | OH | 2 | 80,000.00 | 1,120,000 | | |
| Helper Dump Truck | OH | 2 | 80,000.00 | 1,120,000 | | |
| WEEK 5 | | | | | 17,570,000.00 | |
| Helper Bulldozer | OH | 2 | 80,000.00 | 1,120,000 | | |
| Helper Wheel Loader | OH | 2 | 80,000.00 | 1,120,000 | | 37,380,000.00 |
| Helper Dump Truck | OH | 2 | 80,000.00 | 1,120,000 | | |
| Helper Bore Pile Machine | OH | 2 | 80,000.00 | 1,120,000 | | |
| - Reinforcement | | | | | | |
| Worker | OH | 17 | 80,000.00 | 9,520,000 | | |
| Head Worker | OH | 4 | 100,000.00 | 2,800,000 | | |
| Foreman | OH | 1 | 110,000.00 | 770,000 | | |
| WEEK 6 | | | | | 13,090,000.00 | |
| - Reinforcement | | | | | | |
| Worker | OH | 17 | 80,000.00 | 9,520,000 | | |
| Head Worker | OH | 4 | 100,000.00 | 2,800,000 | | |
| Foreman | OH | 1 | 110,000.00 | 770,000 | | |
| WEEK 7 | | | | | 13,090,000.00 | |
| - Reinforcement | | | | | | |
| Worker | OH | 17 | 80,000.00 | 9,520,000 | | |
| Head Worker | OH | 4 | 100,000.00 | 2,800,000 | | |
| Foreman | OH | 1 | 110,000.00 | 770,000 | | |
| WEEK 8 | | | | | 25,830,000.00 | |
| - Reinforcement | | | | | | |
| Worker | OH | 32 | 80,000.00 | 17,920,000 | | |
| Head Worker | OH | 8 | 100,000.00 | 5,600,000 | | |
| Foreman | OH | 3 | 110,000.00 | 2,310,000 | | |
| WEEK 9 | | | | | 12,740,000.00 | 77,420,000.00 |
| - Reinforcement | | | | | | |
| Worker | OH | 15 | 80,000.00 | 8,400,000 | | |
| Head Worker | OH | 4 | 100,000.00 | 2,800,000 | | |
| Foreman | OH | 2 | 110,000.00 | 1,540,000 | | |
| WEEK 10 | | | | | 25,760,000.00 | |
| - Reinforcement | | | | | | |
| Worker | OH | 25 | 80,000.00 | 14,000,000 | | |
| Head Worker | OH | 8 | 100,000.00 | 5,600,000 | | |
| Foreman | OH | 8 | 110,000.00 | 6,160,000 | | |

**Table 9.** Recapitulation Castflow

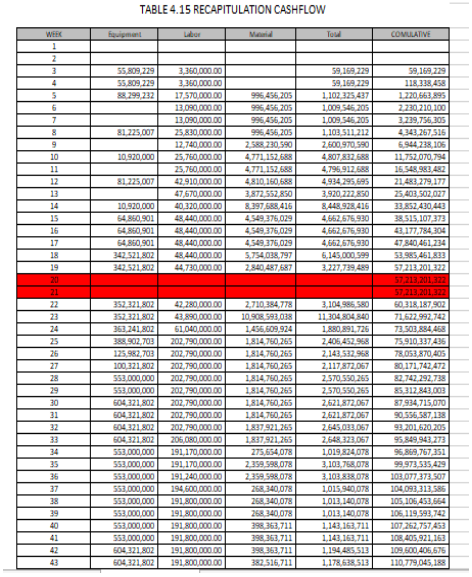


TABLE 4.15 RECAPITULATION CASHFLOW

| WEEK | Equipment | Labor | Material | Total | COMULATIVE |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | 55,809,229 | 3,360,000.00 | | 59,169,229 | 59,169,229 |
| 4 | 55,809,229 | 3,360,000.00 | | 59,169,229 | 118,338,458 |
| 5 | 88,299,232 | 17,570,000.00 | 996,456,205 | 1,102,325,437 | 1,220,663,895 |
| 6 | | 13,090,000.00 | 996,456,205 | 1,009,546,205 | 2,230,210,100 |
| 7 | | 13,090,000.00 | 996,456,205 | 1,009,546,205 | 3,239,756,305 |
| 8 | 81,225,007 | 25,830,000.00 | 996,456,205 | 1,103,511,212 | 4,343,267,516 |
| 9 | | 12,740,000.00 | 2,588,230,590 | 2,600,970,590 | 6,944,238,106 |
| 10 | 10,920,000 | 25,760,000.00 | 4,771,152,688 | 4,807,832,688 | 11,752,070,794 |
| 11 | | 25,760,000.00 | 4,771,152,688 | 4,796,912,688 | 16,548,983,482 |
| 12 | 81,225,007 | 42,910,000.00 | 4,810,160,688 | 4,934,295,695 | 21,483,279,177 |
| 13 | | 47,670,000.00 | 3,872,552,850 | 3,920,222,850 | 25,403,502,027 |
| 14 | 10,920,000 | 40,320,000.00 | 8,397,688,416 | 8,448,928,416 | 33,852,430,443 |
| 15 | 64,860,901 | 48,440,000.00 | 4,549,376,029 | 4,662,676,930 | 38,515,107,373 |
| 16 | 64,860,901 | 48,440,000.00 | 4,549,376,029 | 4,662,676,930 | 43,177,784,304 |
| 17 | 64,860,901 | 48,440,000.00 | 4,549,376,029 | 4,662,676,930 | 47,840,461,234 |
| 18 | 342,521,802 | 48,440,000.00 | 5,754,038,797 | 6,145,000,599 | 53,985,461,833 |
| 19 | 342,521,802 | 44,730,000.00 | 2,840,487,687 | 3,227,739,489 | 57,213,201,322 |
| 20 | | | | | 57,213,201,322 |
| 21 | | | | | 57,213,201,322 |
| 22 | 352,321,802 | 42,280,000.00 | 2,710,384,778 | 3,104,986,580 | 60,318,187,902 |
| 23 | 352,321,802 | 43,890,000.00 | 10,908,593,038 | 11,304,804,840 | 71,622,992,742 |
| 24 | 363,241,802 | 61,040,000.00 | 1,456,609,924 | 1,880,891,726 | 73,503,884,468 |
| 25 | 388,902,703 | 202,790,000.00 | 1,814,760,265 | 2,406,452,968 | 75,910,337,436 |
| 26 | 125,982,703 | 202,790,000.00 | 1,814,760,265 | 2,143,532,968 | 78,053,870,405 |
| 27 | 100,321,802 | 202,790,000.00 | 1,814,760,265 | 2,117,872,067 | 80,171,742,472 |
| 28 | 553,000,000 | 202,790,000.00 | 1,814,760,265 | 2,570,550,265 | 82,742,292,738 |
| 29 | 553,000,000 | 202,790,000.00 | 1,814,760,265 | 2,570,550,265 | 85,312,843,003 |
| 30 | 604,321,802 | 202,790,000.00 | 1,814,760,265 | 2,621,872,067 | 87,934,715,070 |
| 31 | 604,321,802 | 202,790,000.00 | 1,814,760,265 | 2,621,872,067 | 90,556,587,138 |
| 32 | 604,321,802 | 202,790,000.00 | 1,837,921,265 | 2,645,033,067 | 93,201,620,205 |
| 33 | 604,321,802 | 206,080,000.00 | 1,837,921,265 | 2,648,323,067 | 95,849,943,273 |
| 34 | 553,000,000 | 191,170,000.00 | 275,654,078 | 1,019,824,078 | 96,869,767,351 |
| 35 | 553,000,000 | 191,170,000.00 | 2,359,598,078 | 3,103,768,078 | 99,973,535,429 |
| 36 | 553,000,000 | 191,240,000.00 | 2,359,598,078 | 3,103,838,078 | 103,077,373,507 |
| 37 | 553,000,000 | 194,600,000.00 | 268,340,078 | 1,015,940,078 | 104,093,313,586 |
| 38 | 553,000,000 | 191,800,000.00 | 268,340,078 | 1,013,140,078 | 105,106,453,664 |
| 39 | 553,000,000 | 191,800,000.00 | 268,340,078 | 1,013,140,078 | 106,119,593,742 |
| 40 | 553,000,000 | 191,800,000.00 | 398,363,711 | 1,143,163,711 | 107,262,757,453 |
| 41 | 553,000,000 | 191,800,000.00 | 398,363,711 | 1,143,163,711 | 108,405,921,163 |
| 42 | 604,321,802 | 191,800,000.00 | 398,363,711 | 1,194,485,513 | 109,600,406,676 |
| 43 | 604,321,802 | 191,800,000.00 | 382,516,711 | 1,178,638,513 | 110,779,045,188 |

## 4.9. ANALISIS CRITICAL PATH METHOD (CPM)

1) Identification Activities

The first step taken in compiling the Network planning is identifying activities, namely by doing work and identifying activities, namely by doing work and identifying the scope of the project, outlining and solving it into activities of the main road on the CISUMDAWU Toll Road. Sumedang is as follows :

**Table 10.** List of Project Activities.

| No | JOB DESCRIPTION | CODE OF ACTIVITY |
|---|---|---|
| **1** | **PREPARATION WORK** | A |
| **2** | **EARTHWORK** | |
| **3** | **FOUNDATION WORK** | |
| 3.1 | Bore Pile Work | B |
| 3.2 | Footing Work | C |
| **4** | **STRUCTURE** | |
| 4.1 | Abutment | D |
| 4.2 | Pier | E |
| 4.3 | Stressing Girder | F |
| 4.4 | Diafragma | G |
| **5** | **FINISHING** | H |

## 4.10. IDENTIFYING THE RELATIONSHIP BETWEEN ACTIVITIES

In CPM, compile components according to the order of logic of dependence through the basis of making the work term so that it is known for activities from the start of the project until the completion of the project as a whole.

There are several possibilities that can occur from the relationship between activities that are arranged into a chain for activities with the logic of their dependencies, namely:

- An activity can be carried out simultaneously with other activities,
- An activity can be carried out if the previous activity has been completed,
- A job in an independent manner without having to wait for previous activities

The sequence of activities that are in accordance with the logic of their dependence on the Cinapel Bridge on the CISUMDAWU Toll Road, the sequence of activities can be seen in the table below :

**Table 11.** Activity Sequence List.

| No | JOB DESCRIPTION | DURATION WEEK | CODE OF ACTIVITY | PREDECESSOR |
|---|---|---|---|---|
| **1** | **PREPARATION WORK** | | A | |
| **2** | **EARTHWORK** | 3 | | |
| **3** | **FOUNDATION WORK** | | | |
| 3.1 | Bore Pile Work | 17 | B | A |
| 3.2 | Footing Work | 24 | C | A |
| **4** | **STRUCTURE** | | | |
| 4.1 | Abutment | 8 | D | A |
| 4.2 | Pier | 79 | E | C |
| 4.3 | Stressing Girder | 51 | F | C |
| 4.4 | Diafragma | 2 | G | E |
| **5** | **FINISHING** | 11 | H | E |

## 4.11. ADVANCED CALCULATION

The purpose of this study was to obtain the earliest time (EETA = Earliest Event Time Node A) at the A node and the earliest start time (EETN = Earliest Event Time Node N) on N nodes in all activities, with maximum values, as well as values as follows :

- ES (*Earliest Start*) : when you first start the activity.
- EF (*Earliest Finish*) : the fastest time for the end of the activity.

**Table 12.**. Advanced Calculation
**FOWARD CALCULATION**

| EVENT NUMBER | ACTIVITY | ES | DURATION | EF |
|---|---|---|---|---|
| S | | 0 | 0 | 0 |
| 1 | A | 0 | 3 | 3 |
| 2 | C | 3 | 24 | 27 |
| | B | 3 | 17 | 20 |
| | D | 3 | 8 | 11 |
| 3 | E | 27 | 79 | 106 |
| | F | 27 | 51 | 78 |
| F | H | 106 | 11 | 117 |
| | G | 106 | 2 | 108 |

## 4.12. REVERSE CALCULATION

The purpose of the Backward Pass is to get the latest time (LETA = Latest Event Time Node A) at the N node and the completion time at the latest (LET N = Latest Event Time N node) node of all activities by taking the minimum value, so also with the values below:

- LF (Latest Finish) : when no later than the end of the activity.
- LS (Latest Start) : when at the latest to start the activity.

**Table 13.**. Reverse Calculation
**BACKWARD CALCULATION**

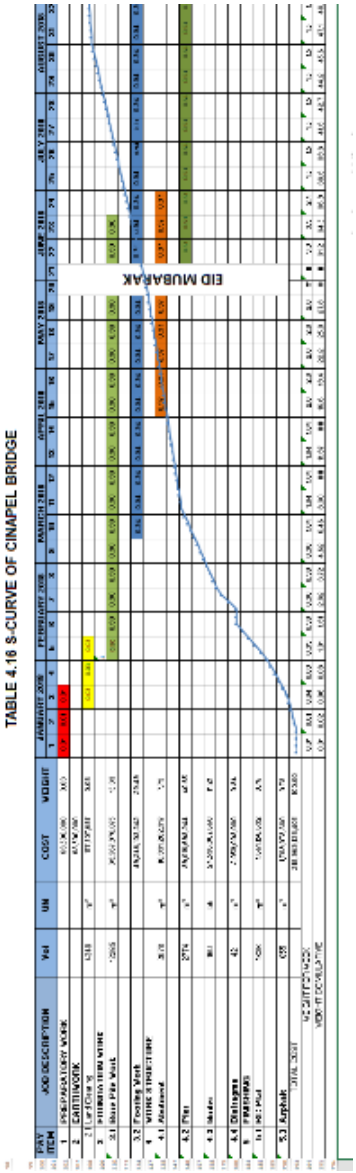
| EVENT NUMBER | ACTIVITY | ES | DURATION | EF |
|---|---|---|---|---|
| F | | 117 | 0 | 117 |
| 3 | H | 106 | 11 | 117 |
| | G | 115 | 2 | 117 |
| 2 | E | 27 | 79 | 106 |
| | F | 101 | 5 | 106 |
| 1 | C | 3 | 24 | 27 |
| | B | 10 | 17 | 27 |
| | D | 19 | 8 | 27 |
| S | A | 0 | 3 | 3 |

### 4.13. IDENTYFY CRITICAL PATHS, FLOAT

Critical Path Method, where the approach used only uses one type of duration in the activity. The critical path is the path with a collection of activities having the longest duration that can be known if the activity has Float Total 0.

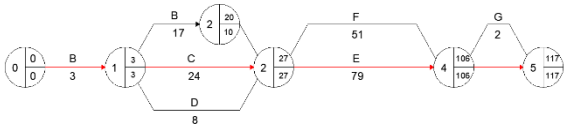
The definition of a critical path in this step is a path that consists of a series of activities within the project scope, which if too late will result in overall project delays, activities that are in this path are called critical activities, while the float is a non-time activity critical of the project.

**Table 14.**. Total Float




**FREE FLOAT AND TOTAL FLOAT CALCULATION**

| DURATION | Forward calculation | | Backward calculation | | TF | DESCRIPTION |
|---|---|---|---|---|---|---|
| | ES | EF | LS | LF | | |
| | | | | | | |
| 3 | 0 | 0 | 3 | 0 | 0 | Critical Path |
| 17 | 3 | 10 | 27 | 0 | 7 | Not a Critical path |
| 24 | 3 | 3 | 27 | 0 | 0 | Critical Path |
| 8 | 3 | 19 | 27 | 0 | 16 | Not a Critical path |
| 79 | 27 | 27 | 106 | 0 | 0 | Critical Path |
| 51 | 27 | 27 | 106 | 0 | 28 | Not a Critical path |
| 2 | 106 | 101 | 117 | 0 | 9 | Not a Critical path |
| 11 | 106 | 106 | 117 | 0 | 0 | Critical Path |




### 4.14. ANALYSIS OF S CURVES

As for the planning and result of the weight calculation the using S curve analysis is a follows.

## 5. CONCLUSION & SUGGESTION

### 5.1. CONCLUSION

Here are some conclusions that the author succeeds in summarizing the results of the management activities of the Bore Pile foundation work on the Cinapel Bridge on the CISUMDAWU Toll Road, Kab. Sumedang :

1. The calculation of the volume on the Cinapel Bridge on the CISUMDAWU Toll Road is as follows:
   a. Total volume of land clearing work: 4348,45 m²
   b. The total Volume of excavation work for *Bore Pile* : 12.264,84 m³
   c. Total footing volume : 6273 m³
   d. Total abutment volume : 1539 m³
   e. Volume of total pier : 3448 m³
   f. Volume of total pier head : 1244 m³
   g. Volume total PC – I Girder : 160 pieces
   h. Diafragma total volume : 42 m³
   i. Total volume of Rc Plate : 1636 m³
   j. Total volume of Aspalt : 653 m³

2. The initial project planning is carried out at the beginning of the first week of the month - month one. From the calculation of work weights based on barchart analysis, the S curve and CPM job scheduling on Cinapel Bridge on CISUMDAWU Toll Road takes 903 days (129 weeks).
3. Based on the calculation of the Budget Plan (RAB) to complete the Cinapel Bridge on the CISUMDAWU Toll Road, Kab. Sumedang costs approximately Rp. 168,020,632,320, - (One hundred sixty eight billion twenty million six hundred thirty two thousand three hundred twenty).
4. Using the CPM Method can be known critical trajectories that occur on the project, namely preparatory work - land preparation - Footing - Pier - Finishing.

### 5.2. SUGGESTION

**a.** Detailed studies need to be carried out in calculating the budget plan to get the right cost arrangement.

**b.** In planning the scheduling of project completion time, it is not only analyzing based on the calculation of the work weights, but is strongly influenced by experience in the field.

**c.** The CPM method is very helpful in overcoming the time to complete the project. Companies can use the CPM method in the network planning of Cinapel Bridge on CISUMDAWU Toll Road in Sumedang Regency in order to improve better effectiveness, because the company can see which activities need to be prioritized.

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