# The Calculation of Time and Cost Estimation on Implementing Box Girder with Balance Cantilever Method in the *Cakung* Fly Over Project

Ryan Dordia Wiratama Metar, Achmad Faiz Hadi Prajitno dan Akhmad Yusuf Zuhdy

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

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ABSTRACT

The Cakung Flyover Development Project is one of the programs of the DKI Jakarta Provincial government, through the Bina Marga of DKI Jakarta Province 2019-2020 which will build several non-level intersections in the form of underpasses and flyovers with the aim of reducing traffic jams in the capital region, more specifically congestion which often occurs in the East Primary Sentra area, namely on the Jatinegara-Bekasi railroad line. The Cakung Flyover is located in I Gusti Ngurah Rai Street and turns towards the new Cakung road by passing the Jakarta-Bekasi railroad crossing. This Flyover has a length of 760 meters and a width of 18 meters with the longest span of 80m from P8 and P9 which turn towards the new Cakung road and is between the railroad crossings. This Flyover used the Balance Cantilever Cast in situ method with the traveler form in Box Girder work from P7 to P10. This Applied Final Project discusses about the estimated time and cost needed to complete the Cakung Flyover structure starting from P7 to P10 on the 180-meter box girder work consisting of 32 segments using the balance cantilever method with the traveler form. Based on the analysis carried out, the results were obtained

## INTRODUCTION

Indonesia is one of the countries with the fourth most population in the world, which makes it obvious that traffic jam is one of the problems that must be solved by Indonesia as one of the countries with the most densely population, especially in the capital area. In order to face this challenge, the construction of roads and bridges is one of the efforts made by the provincial government of DKI Jakarta to reduce congestion that occurs due to the volume of roads that can no longer accommodate the volume of vehicles. A road or bridge construction project will show maximum results if a plan which includes detailed planning of costs implementation, duration of work, as well as implementation methods in the field.

Flyover (Jembatan Layang) is a bridge over an existing road which functions to connect two sections of the road which are disconnected due to obstacles on a road that has a level crossing. There are so many level crossings on the Jatinegara - Bekasi railroad line which causes traffic problems around the railroad crossings. There are five major level crossings between roads and railroads, of which four level crossings have been upgraded to be non-level crossings so that currently there is only one crossing that needs to be upgraded to be non-level crossing, namely at the Cakung station crossing. The construction of the Cakung Flyover is enabled to break up the congestion points happened in Jalan I Gusti Ngurah Rai due to the level crossing that passes through the Jakarta - Bekasi train line.

On this final project the construction management object which has been planned is the structural work of the Cakung Flyover construction project starting from pillar 7 to pillar 10 with a total length of 181 meters consisting of 32 Box Girder segments using the balance cantilever method with the traveller form. The Flyover construction is located in I Gusti Ngurah Rai street East Jakarta, passing the Jakarta-Bekasi railroad crossing with a length of 760 meters and a width of 18 meters which is divided into two zones, namely zone 1 and zone 2.

## LITERATURE REVIEW

### *A. General*

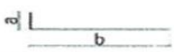
It is an obligation to put review of literature in a paper or report. This chapter contains a meaning of the base theory that used to explain the discussion part on a paper.

### *B. Balance*

Balance cantilever is one of the methods used in constructing cast bridge, in-situ or using precast concrete by applying the benefits of balance cantilever effect so that the structures can handle its own weight without other supports (scaffolding) in which the upper structure construction process is done on the upper part of the

Table 1. The Calculation of Pile Cap Volume

| Pile Cap | Dimension (m) | | | Volume (m3) | V. Reinforcement (m3) | V. Cast (m3) | V. Excavation (m3) | V. Formwork (m2) |
|---|---|---|---|---|---|---|---|---|
| | Length | Width | Height | | | | | |
| P7 | 11,4 | 11,4 | 2,5 | 324,9 | 5,5577223 | 319,3423 | 324,9 | 114 |
| P8 | 17,3 | 11,7 | 3 | 739,5 | 2,5960637 | 736,9039 | 739,5 | 191,7 |
| P9 | 14,5 | 14,5 | 3 | 630,75 | 3,5968017 | 627,1532 | 630,75 | 188,5 |
| P10 | 11,4 | 11,4 | 2,5 | 324,9 | 5,5577223 | 319,3423 | 324,9 | 114 |

| No. | Kode | Gambar | Diameter (mm) | Berat (kg/m') | Panjang a (m) | b (m) | c (m) | d (m) | e (m) | Panjang Unit (m) | Jumlah Unit (bh) | Total Panjang (m) | Berat Total (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A.1 |  | D 32 - 150 | 6.313 | 0.20 | 2.30 | 9.50 | | | 12.00 | 76 | 912 | 5757.77 |
| 2 | A.2 |  | D 32 - 150 | 6.313 | 2.98 | 2.30 | 0.20 | | | 5.48 | 76 | 416.48 | 2629.38 |
| 3 | A.3 |  | D 32 - 150 | 6.313 | 0.20 | 11.20 | 0.20 | | | 11.60 | 76 | 881.6 | 5565.84 |
| 4 | A.4 |  | D 32 - 150 | 6.313 | 11.20 | | | | | 11.20 | 76 | 851.2 | 5373.92 |
| 5 | B.1 |  | D 32 - 150 | 6.313 | 0.20 | 2.23 | 9.57 | | | 12.00 | 76 | 912 | 5757.77 |
| 6 | B.2 |  | D 32 - 150 | 6.313 | 2.91 | 2.23 | 0.20 | | | 5.34 | 76 | 405.84 | 2562.21 |
| 7 | B.3 |  | D 32 - 150 | 6.313 | 0.20 | 11.20 | 0.20 | | | 11.60 | 76 | 881.6 | 5565.84 |
| 8 | B.4 |  | D 32 - 150 | 6.313 | 11.20 | | | | | 11.20 | 76 | 851.2 | 5373.92 |
| 9 | C.1 |  | D 16 | 1.578 | 0.64 | 11.2 | | | | 11.84 | 24 | 284.16 | 448.50 |
| 10 | D.1 |  | D 16 | 1.578 | 0.1 | 2.3 | 0.1 | | | 2.5 | 1164 | 2910 | 4592.96 |
| | | | | | | | | | | | TOTAL | | 43628.12 |

Picture 1. Requirement of Pile Cap Reinforcement P7

structure without disturbing the construction or the condition on its lower part. The following are the types of construction methods of *balance cantilever* method.

1. *Balance cantilever method* with *launching gantry.*

This method is normally used to the precast concrete bridge and not the result of *in-situ* casting. This method uses one gantry or more which functioned as segments launcher of the existing *box girder*.

2. *Balance cantilever method* with *lifting frame.*

This method is almost the same with *launching gantry*, the different can be seen from the utilization of the tool, namely lifting frame to lift the segments of the bridge.

3. *Balance cantilever method* with *crane.*

Basically, this method is the same with *liftring frame method.* The different can be found on the different tools used, namely a crane to lift the segments of the bridge.

4. *Balance cantilever method* with *full-span system*

On this method, the segment lifted is one full-span segment for a span. Therefore, this method is appropriate for a bridge with the condition of the distance between the pedestals are not too far.

5. *Balance cantilever method* with *form traveller*

This method is applied to the bridge with in-situ casting method. On this method, form *traveller* has a function to form the segments of the bridge according to the plan.

*C. Working Volume*

Working volume is the result of calculating the volume of work in one job which represented in cubic meters ($m^3$). Volume is also often referred as work *cubication*. Therefore, the volume (*cubication*) of a work is not volume (the actual content), but the total volume of working parts in one unit.

*D. Budgeting Plan (RAB)*

RAB or Budgeting Plan is a method of describing the budgeting plan that must be allocated to a certain job from the beginning to the end of the work. The budgeting plan needs to cover the entire work, including the cost of the materials, tool rental, worker wages, and other costs.

The Unit Price of the Materials and the Labor Wages is varied in every region, therefore, in calculating and preparing the Budgeting Plan in a project must be based on the unit price and labor wages in the market and location of the project.

*E. S Curve*

S Curve is the plot result of *Barchart,* aimed to make

Table 2. Pile Cap Manpower Requirements for Iron

| No | Manpower | Koef | Maximum capacity of the workers in 1 group | Work used |
|---|---|---|---|---|
| 1 | Foreman | 0,000706 | 1 | 1 |
| 2 | Handyman | 0,007063 | 10 | 6 |
| 3 | Worker | 0,007067 | 10 | 12 |

Table 3. Pile Cap Formwork Manpower Requirement

| No | Manpower | Koef | Maximum capacity of the workers in 1 group | Setting and installing workers | Opening and cleaning workers |
|---|---|---|---|---|---|
| 1 | Foreman | 0,033 | 1 | 2 | 2 |
| 2 | Handyman | 0,333 | 10 | 4 | 0 |
| 3 | Worker | 0,666 | 20 | 10 | 20 |

Table 4. Size Chart and Iron Weight

| Diameter (mm) | Weight (kg/m) | Cutting Size Cm2 |
|---|---|---|
| 6 | 0.222 | 0.28 |
| 8 | 0.395 | 0.50 |
| 10 | 0.627 | 0.79 |
| 12 | 0.888 | 1.13 |
| 14 | 1.208 | 1.54 |
| 16 | 1.578 | 2.01 |
| 19 | 2.226 | 2.84 |
| 22 | 2.984 | 3.80 |
| 25 | 3.853 | 4.91 |

(Source : Ir. A. Soedrajat S, 1984) [1]

Table 5. Labor working hours needed to make 100 bent and hook

| Size of Concrete Iron | Using Hand | | Using Machine | |
|---|---|---|---|---|
| | Bent (Hour) | Hook (Hour) | Bent (Hour) | Hook (Hour) |
| 12 mm below | 2 - 4 | 3 - 6 | 0.8 - 1.5 | 1.2 - 2.5 |
| 16 mm<br>19 mm<br>22 mm | 2.5 - 5 | 4 - 8 | 1 - 2 | 1.6 - 3 |
| 25 mm<br>28.5 mm | 3 - 6 | 5 - 10 | 1.2 - 2.5 | 2 - 4 |
| 31.75 mm<br>38.1 mm | 4 - 7 | 6 - 12 | 1.5 - 3 | 2.5 - 5 |

(Source : Ir. A. Soedrajat S, 1984) [1]

it easier to observe the incoming activity in a certain range of project implementing time. (Callahan, 1992).

S Curve can be used as the tester for economic value and setting the burden on resources, as well as placement, testing the combination of activities against working plans, as a comparison of the actual performance of target plan or budgeting plan for the purpose of evaluating funds for analyzing deviation occur. The characteristics of working development can be depicted in a form of cumulative percentage of conduction prestation value or from the production, value of money that used to buy something, quantity numbers of working volumes, as well as the requirements from every resource and from many other forms.

The letter S on the phrase S Curve is caused by the activities during the project, those are as follows:

1. Progress which was slow on the beginning
2. Followed by activities that run fast in a supposed to be a long period of time.
3. Finally, the speed of the progress decreased and stop at the end point.

From the explanation above, it can be concluded that S curve should be run slowly in the beginning of the project, and then getting faster in the middle and slower at the end of the project schedule. The shape of the graph needs to be made very well and carefully since it will affect the flow of money during the project as well as the scheduling of materials arrival and many others.

## METHODOLOGY

### *A. Preparation Stage*

Preparation stage is a stage in which the writer seeks for information about the title of the project. This stage consists of:

a. Administration Preparation

The quality factor of human resources consists of the variable level of education, the population dependency ratio, and the number of workers.

b. Collecting Data and Literature

The data required for this Final Project are image data (DED), location of the project, job specification, DKI Jakarta Main Activity Unit Prices and books to support data processing on this Final Projects, those are as follow:

1. Collecting the theoretical framework of project management
2. Reviewing rules and regulations
3. Studying the preparation of scheduling project
4. Studying the calculation for the budgeting plan

### *B. Data Study*

1. Technical Drawing Analysis

The technical drawing is the main data which is needed in a project and applied on this Final Project. From the technical drawing, the amount of volume and materials needed for the construction of the *Cakung Fly Over* can be obtained. After figuring out the number of volumes and materials specification, the total cost or budgeting plan (RAB) needed to carry out the project will also be obtained.

2. Determining the Working Items

Determining the main structural items or types of the works in the Cakung Fly Over which includes the works of *Borepile, pile cap, pier, pierhead, Form Traveller Balance Cantilever, Box Girder.*

1). Preparation of the Work
   a. The work on land clearing and demolition
   b. The work on tools mobilization
   c. Procurement of executive temporary office
   d. Procurement of materials warehouse
   e. The work on measurement

2). *Borepile* Foundation Work
   a. Drilling with *rotary drilling*
   b. *Casing* installation
   c. *Boredpile* reinforcement installation
   d. Casting with *tremi* pipe
   e. Checking the concrete volume on the *boredpile.*

3). *Pile Cap Work*
   a. Digging the ground according to the planned depth at predetermined coordinate point
   b. Cutting the *bored pile* concrete based on the evaluation which has been conducted

Table 6. Working hours to build 100 pieces of reinforcing bars (rebar)

| Size of Concrete Iron | Reinforcing Bars Length | | |
|---|---|---|---|
| | Below 3 m | 3 - 6 m | 6 - 9 m |
| 1 /2" (12 mm)<br>5/8" (16 mm) | 3.5 - 6 | 5 -7 | 6 - 8 |
| 3/4" (19 mm)<br>7/8" (22 mm) | 4.5 - 7 | 6 - 8.5 | 7 - 9.5 |
| 1" (25 mm)<br>1 1/8" (28.5 mm) | 5.5 - 8 | 7 - 10 | 8.5 - 11.5 |
| 1 1/4" (31.75 mm)<br>1 ½" (38.1 mm) | 6.5 - 9 | 8 - 12 | 10 - 14 |

(Source : Ir. A. Soedrajat S, 1984)

Table 7. Estimated Mold Requirements every 10m2

| Types of the mold | Wood | Nail, Bolt, and Wire (Kg) |
|---|---|---|
| 1. Foundation/Bridge Aisle | 0.46 - 0.81 | 2.73 - 5 |
| 2. Wall | 0.46 - 0.62 | 2.73 - 4 |
| 3. Floor | 0.41 - 0.64 | 2.73 - 4 |
| 4. Roof | 0.46 - 0.69 | 2.73 - 4.55 |
| 5. Pillars | 0.44 - 0.74 | 2.73 - 5 |
| 6. Pillar Head | 0.46 - 0.92 | 2.73 - 5.54 |
| 7. Blocks | 0.69 - 1.61 | 3.64 - 7.27 |
| 8. Stairs | 0.69 - 1.38 | 3.64 - 6.36 |
| 9. Pillars Angle/Carved* Blocks | 0.46 - 1.84 | 2.73 - 6.82 |
| 10. Windows and lintel* | 0.58 - 1.84 | 3.18 - 6.36 |

(Source : Ir. A. Soedrajat S, 1984) [1]

Table 8. Working Hours Koefisien every 10 m2

| Types of the wooden mold | Working Hours per 10m2 mold area | | |
|---|---|---|---|
| | Setting | Installing | Dismantling |
| 1. Foundation/Bridge Aisle | 3 - 7 | 2 - 4 | 2 - 4 |
| 2. Wall | 5 - 9 | 3 - 5 | 2 - 5 |
| 3. Floor | 3 - 8 | 2 - 4 | 2 - 4 |
| 4. Roof | 3 - 9 | 2 - 5 | 2 - 4 |
| 5. Pillars | 4 - 8 | 2 - 4 | 2 - 4 |
| 6. Pillar Head | 5 - 11 | 3 - 7 | 2 - 5 |
| 7. Blocks | 6 - 10 | 3 - 4 | 2 - 5 |
| 8. Stairs | 6 - 12 | 4 - 8 | 2 - 5 |
| 9. Pillars Angle/Carved* blocks | 5 - 11 | 3 - 9 | 3 - 5 |
| 10. Windows/Lintel* | 5 - 10 | 3 - 6 | 3 - 5 |

(Source : Ir. A. Soedrajat S, 1984) [1]

c. L*ean concrete* casting
d. Installation of *Pile Cap* reinforcement
e. Installation of *pile cap* formwork
f. *Pile Cap* casting

4). Pier Work
a. Installation of pier reinforcement
b. Installation of *pier* formwork
c. Casting of the pier per segments according to the implementation method

5). *Pierhead* Work
a. Installation of Shoring
b. Installation of pier head formwork
c. Installation of pier head reinforcement
d. Pierhead Casting process in stages.

6). *Pot Bearing* Work
a. Installation of pot bearing formwork
b. Casting on the pot bearing based on the implementation method.
c. Installation of LRB

7). *Form Traveller Balance Cantilever* Work
a. Installation work of form traveller
b. Launching work of Traveller

8). *Box Girder* Work
a. Launching work of traveller
b. Installation work of box girder reinforcement
c. Casting work of box girder
d. Stressing work of box girder
e. Curing work

3. Preparation of Implementation Method

Implementation method is a description of the procedures and techniques for carrying out work.

obtained from the preparation of types of work in order to get an effective and efficient time. From the discussion above, it can be knwon which of the activities should be done first or carried out together based on the literature and project data.

*C. Calculation*

The calculation stage is a calculation method in planning the project in the form of productivity, unit price calculations, or the calculation of the duration to build the Cakung *Fly Over*.

1. Calculation of Work Productivity

Work productivity can be described as the calculation of the total duration of each item or type of work by combining the workers and tools with the aim of getting an effective and efficient duration/time.

2. Calculation of Budgeting Plan

The calculation of budgeting plan (RAB) is gained from calculating the volume of technical or planning

Table 9. D32 Pile Cap Productivity

| D | Working hours / 100 pieces | | | Productivity | |
|---|---|---|---|---|---|
| 32 | Bending | 2 | Hour | 6300 | Pieces/day |
| 32 | Cutting | 2,5 | Hour | 5040 | Pieces/day |
| 32 | Setting | 13 | Hour | 969 | Pieces/day |
| 32 | Binding | 4 | Hour | 3150 | Pieces/day |

Table 10. D25 Pile Cap Productivity

| D | Working hours / 100 pieces | | | Productivity | |
|---|---|---|---|---|---|
| 25 | Bending | 2 | Hour | 6300 | Pieces/day |
| 25 | Cutting | 2 | Hour | 6300 | Pieces/day |
| 25 | Setting | 10 | Hour | 1260 | Pieces/day |
| 25 | Binding | 3 | Hour | 4200 | Pieces/day |

Table 11. D16 Pile Cap Productivity

| D | Working hours / 100 pieces | | | Productivity | |
|---|---|---|---|---|---|
| 16 | Bending | 1 | Hour | 12600 | Pieces/day |
| 16 | Cutting | 1,5 | Hour | 8400 | Pieces/day |
| 16 | Setting | 8,5 | Hour | 1482 | Pieces/day |
| 16 | Binding | 2,5 | Hour | 5040 | Pieces/day |

Table 12. Formwork Pile Cap Productivity

| Types of work | Working hours / 10 m2 | Productivity m2 / day |
|---|---|---|
| Setting | 5 hours | 98 |
| Installing | 3 hours | 163 |
| Dismantling | 3 hours | 140 |
| Repairing | 3 hours | 140 |

Table 13. Workers Pricelist

| No | Position | Unit | Unit Price | Description |
|---|---|---|---|---|
| 1 | Worker | Days | 174.748 | HSPK 2020 |
| 2 | Handyman | Days | 183.883 | HSPK 2020 |
| 3 | Blacksmith | Days | 183.884 | HSPK 2020 |
| 4 | Woodcarver | Days | 183.834 | HSPK 2020 |
| 5 | Digger | Days | 183.834 | HSPK 2020 |
| 6 | Foreman | Days | 211.379 | HSPK 2020 |
| 7 | Supporting Heavy equipment operator | Days | 183.834 | HSPK 2020 |
| 8 | Heavy equipment operator | Days | 211.379 | HSPK 2020 |

drawings and based on the basic unit price or carefully assumed prices related to project implementation. To make it easier to gain the cost for the project, it is necessary to describe the types of work on the construction of Cakung *Fly Over*.

3. Preparation of P Network Planning

The preparation of *network planning* is aimed to determine the critical path pf the project. The critical path shows that the work/activities on that path is required to be on time, which is not late in the starting and finishing point. It is necessary to have a sequences arrangement to obtain maximum results on *Network Planning,* so it can minimize critical paths on the works items of the *Cakung Fly Over*.

4. Compiling the S Curve

After calculating the budgeting plan and preparing the Network Planning, the S curve calculation and compilation can be made. On the S curve diagram, the focus is on monitoring the implementation of the project in the field, especially in the term of cost and work performance. In order to obtain a maximum result of S curve, it is necessary to pay attention to the scheduling of materials, labor, and equipment used on the project. The S curve should be done as good as possible to determine the project completion time, determine the amount of project implementation costs and the time needed for materials and tools which are going to be used.

## DISCUSSIONS

### *A. S Curve*

The calculation of the working volume on the project is gained from the calculation of technical image analysis. Below is the example of the volume on pile cap work. Shown on Table 1 and Image 1.

Volume Calculation:

- Volume = p x l x t
- Ironing = total weight (kg) / 7850
  = ..... (m3)
- Formwork = 2 x ( p x l ) x t
- Concrete Calculation = Volume – Ironing Volume

### *B. Productivity Calculation*

1. Ironing Manpower Requirements
   The requirements for the Pile Cap ironing manpower are shown on the Table 2.
2. Formwork Manpower Requirements
   The requirements of Formwork Manpower are shown on the Table 3.
3. Ironing Productivity Calculation
   Size and Iron weight chart is shown on the Table 4. Meanwhile the working hours of the workers to make 100 bend and hook can be seen from Table 5. The working hours to create 100 pieces of

Table 14. Materials Pricelist

| No | Position | Unit | Unit Price | Description |
|---|---|---|---|---|
| 1 | BJT D - 40 Reinforcing Screw Steel BJT | Kg | 12.693 | HSPK 2020 |
| 2 | Concrete wire | Kg | 26.200 | HSPK 2020 |
| 3 | Wire nail | Kg | 38.800 | HSPK 2020 |
| 4 | Ply Wood 1,2 x 2,4 x 0,9 | Lbr | 108.180 | HSPK 2020 |
| 5 | Working Floor Concrete | m3 | 59.019 | HSPK 2020 |
| 6 | Concrete K - 175 | m3 | 740.000 | Adhimix |
| 7 | Concrete K - 250 | m3 | 835.000 | Adhimix |
| 8 | Concrete K - 300 | m3 | 885.000 | Adhimix |
| 9 | Concrete K - 350 | m3 | 935.000 | Adhimix |
| 10 | Concrete K - 400 | m3 | 985.000 | Adhimix |
| 11 | Concrete K - 500 | m3 | 1.075.000 | Adhimix |
| 12 | Lead Rubber Bearing | Unit | 6.525.000 | Hengshui Yundong Rubber Products Co., Ltd. |
| 13 | Form Traveller Balance Cantilever | Set / days | 10.000.000 | Journal |
| 14 | Strand diameter 12,7 mm | Unit | 27.600 | ITS Journal 2013 konversi 2020 |
| 16 | Wedges Anchor Block | Set / days | 104.000 | ITS Journal2013 konversi 2020 |
| 17 | Srayer Ultra Tank CBA | Unit | 500.000 | Website |
| 18 | S Sika Curing Compound | 20 liter / unit | 340.000 | Website |

reinforcement can be found in Table 6. Moreover, the need estimation of mold per 10m2 is shown in Tabel 7. Coefficient Working Time every 10 m2 is shown in Table 8.

*C. Calculation of Duration*

1. Pile Cap Ironing or Reinforcing Duration

a. Cutting

$$D32 = \frac{1442\ pieces}{5040\ Pieces/days} =$$
$$= 0{,}29 \text{ days}$$
$$D25 = \frac{292\ pieces}{6300\ Pieces/days} =$$
$$= 0{,}05 \text{ days}$$
$$D16 = \frac{2376\ pieces}{8400\ Pieces/days} =$$
$$= 0{,}28 \text{ days}$$

Cutting Duration = D32 + D25 + D16
= 0,62 hari

b. Bending

$$D32 = \frac{1060\ pieces}{6300\ Pieces/days} =$$
$$= 0{,}17 \text{ days}$$
$$D25 = \frac{0\ pieces}{6300\ Pieces/days} =$$
$$= 0{,}00 \text{ days}$$

Table; 15. Daftar Harga Sewa Alat

| No | Position | Unit | Unit Price | Description |
|---|---|---|---|---|
| 1 | Borepile Machine | Days | 257.502 | Permen PU 28 thn 2016 Konversi 2020 [2] |
| 2 | Tremie Pipe | m’ | 40.000 | CV. Sokko Pondasi |
| 3 | Scaffolding 190 cm x 190 cm | Set/month | 278.000 | CV. Mitra Solusi Konstruksi |
| 4 | Excavator | Hours | 180.251 | Permen PU 28 thn 2016 Conversion 2020 [2] |
| 5 | Hydraulic Crane 60t | Hours | 2.500.000 | anekawajasa.com |
| 6 | Dump Truck | Days | 288.402 | Permen PU 28 thn 2016 Conversion 2020 |
| 7 | Truck Mixer | Days | 257.501 | Permen PU 28 thn 2016 Conversion 2020 [2] |
| 8 | Concrete Pump | Days | 3.500.000 | Readi Mix Jabodetabek |
| 9 | Concrete Vibrator | Days | 1.000.000 | Readi Mix Jabodetabek |
| 10 | Set Bar Bender & Bar Cutter | Days | 283.333 | CV. Sejati Teknik |
| 11 | Bar Roller | Days | 166.666 | CV. Sejati Teknik |
| 12 | Stressing Jack | Days | 176.500 | Journal ITS 2013 Conversion 2020 |

$$D16 = \frac{4704\ pieces}{12600\ Pieces/days} =$$
$$= 0{,}37 \text{ days}$$

Bending Duration = D32 + D25 + D16
= 0,54 days

c. Installing

$$D32 = \frac{1442\ pieces}{969\ Pieces/days} =$$
$$= 1{,}48 \text{ days}$$
$$D25 = \frac{292\ pieces}{1260\ Pieces/days} =$$
$$= 0{,}23 \text{ days}$$
$$D16 = \frac{2376\ pieces}{1482\ Pieces/days} =$$
$$= 1{,}6 \text{ days}$$

Installing Duration = D32 + D25 + D16
= 3,32 days

d. Hooking

$$D32 = \frac{1828\ pieces}{3150\ Pieces/days}$$
$$= 0{,}58 \text{ days}$$
$$D25 = \frac{146\ pieces}{4200\ Pieces/days}$$
$$= 0{,}03 \text{ days}$$
$$D16 = \frac{0\ pieces}{5040\ Pieces/days}$$
$$= 0 \text{ days}$$

Hooking Duration = D32 + D25 + D16
= 0,61 days

a) Fabrication Duration

Fabrication = Cutting + Bending

Table 16. Pile Cap Reinforcement Fabrication AHSP

| No | COMPONENT | UNIT | QUANTITY ESTIMATION | UNIT PRICE (Rp.) | DURATION(Days) | TOTAL PRICE (Rp.) |
|---|---|---|---|---|---|---|
| A | POWER | | | | | |
| 1 | Worker | Oh | 12,00 | 174.748 | 2 | 4.193.952 |
| 2 | Blacksmith | Oh | 6,00 | 183.834 | 2 | 2.206.008 |
| 3 | Foreman | Oh | 1,00 | 211.379 | 2 | 422.758 |
| | TOTAL PRICE FOR THE WORKER | | | | | 6.822.718 |
| B | MATERIALS | | | | | |
| 1 | BJTD – 40 Reinforcing Screw Steel | kg | 135870,23 | 12.693 | | 1.724.635.877 |
| 2 | Concrete wire | kg | 2038,06 | 26.200 | | 53.397.055 |
| | TOTAL PRICE FOR THE MATERIAL | | | | | 1.778.032.932 |
| C | TOOLS | | | | | |
| 1 | Bar bender & Bar Cutter | Dyas | 6 | 283.333 | 2 | 3.399.999 |
| 2 | Supporting mat | Ls | 2 | - | - | |
| | TOTAL PRICE FOR THE TOOL | | | | | 3.399.996 |
| D | TOTAL PRICE OF THE WORKER, MATERIAL AND TOOL (A + B + C) | | | | | 1.788.255.646 |
| E | OVERHEAD PROFIT 15% x D | | | | | 268.238.347 |
| F | UNIT WORK PRICE (D + E) | | | | | 2.056.493.993 |

Table 17. Formwork Pile Cap Fabrication AHSP

| No | COMPONENT | UNIT | QUANTITY ESTIMATION | UNIT PRICE (Rp.) | DURATION(Days) | TOTAL PRICE (Rp.) |
|---|---|---|---|---|---|---|
| A | POWER | | | | | |
| 1 | Worker | Oh | 20,00 | 174.748 | 2 | 6.989.920 |
| 2 | Woodcarver | Oh | 4,00 | 183.834 | 2 | 1.470.672 |
| 3 | Foreman | Oh | 4,00 | 211.379 | 2 | 1.591.032 |
| | TOTAL PRICE FOR THE WORKERS | | | | | 10.151.624 |
| B | MATERIAL | | | | | |
| 1 | Ply Wood L 2 x 24 x 0.9 | lbr | 212,00 | 108.180 | | 22.934.160 |
| | TOTAL PRICE FOR THE MATERIAL | | | | | 22.934.160 |
| C | TOOLS | | | | | |
| 1 | Supporting tool | Ls | 6 | - | | - |
| | TOTAL PRICE FOR THE TOOL | | | | | - |
| D | TOTAL PRICE OF THE WORKER, MATERIAL AND TOOL (A + B + C) | | | | | 33.085.784 |
| E | OVERHEAD PROFIT 15% x D | | | | | 4.962.868 |
| F | UNIT WORK PRICE (D + E) | | | | | 38.048.652 |

Table 18. Installing Pile Cap Reinforcement AHSP

| No | COMPONENT | UNIT | QUANTITY ESTIMATION | UNIT PRICE (Rp.) | DURATION(Days) | TOTAL PRICE (Rp.) |
|---|---|---|---|---|---|---|
| A | POWER | | | | | |
| 1 | Worker | Oh | 20,00 | 174.748 | 4 | 8.387.904 |
| 2 | Blacksmith | Oh | 6,00 | 183.834 | 4 | 4.412.016 |
| 3 | Foreman | Oh | 1,00 | 211.379 | 4 | 845.516 |
| | TOTAL PRICE FOR THE WORKER | | | | | 13.645.436 |
| B | MATERIAL | | | | | |
| | TOTAL PRICE FOR THE MATERIAL | | | | | - |
| C | TOOL | | | | | |
| 1 | Supporting tools | Ls | 1 | - | | - |
| | TOTAL PRICE FOR THE TOOL | | | | | - |
| D | TOTAL PRICE OF THE WORKER, MATERIAL AND TOOL (A + B + C) | | | | | 13.645.436 |
| E | OVERHEAD PROFIT 15% x D | | | | | 2.046.815 |
| F | UNIT WORK PRICE (D + E) | | | | | 15.692.251 |

= 0,62 days + 0,54 days
= 2 days

b) Installing Duration
Fabrication = Installing + Hooking
= 3,32 days + 0,61 days
= 4 days.

2. Pile Cap Formwork Duration
   a. Setting

$$\text{Setting} = \frac{608{,}5\ m^2}{392\ m^2/days}$$

= 2 days

   b. Installing

$$\text{Installing} = \frac{608{,}5\ m^2}{653\ m^2/\text{days}}$$

= 1 days

   c. Demolishing

$$\text{Demolishing} = \frac{608{,}5\ m^2}{560\ m^2/\text{days}}$$

= 1 days

   d. Repairing

$$\text{Repairing} = \frac{608{,}5\ m^2}{560\ m^2/\text{days}}$$

= 1 days

3. Pile Cap Casting Duration
   a. Production Capacity

Concrete Pump.
Tool Capacity (V) = 8 m³
Tool efficiency factor (Fa) = 0,83
Cycle Time (Ts1) = minutes
Tool Setting (T1) = 15 minutes
Casting (T2) = 10 minutes

Table 22. Calculation of Cost and Duration Recapitulation

| No | Work Description | Volume | Unit Weight | Duration | Price |
|---|---|---|---|---|---|
| | PREPARATION WORK | | | | |
| **I** | **Preparation and Cleaning** | | | | |
| 1 | Mobilization | | | 1 | 140.300.000 |
| 2 | Land Cleaning | 3258,00 | m2 | 4 | 19.494.105 |
| | UNDER STRUCTURE WORK | | | | |
| **II** | **Bored pile Work** | | | | |
| 1 | Borepile Reinforcement Fabrication | 527466,79 | kg | 5 | 7.998.652.220 |
| 2 | Tremi Pipe Fabrication | 1692,00 | m | 4 | 99.068.866 |
| 3 | Borepile Drilling | 1902,00 | m | 6 | 368.744.597 |
| 4 | Borepile Reinforcement | 527466,79 | kg | 8 | 62.769.006 |
| 5 | Tremie Pipe Installation | 1692,00 | m | 4 | 21.236.866 |
| 6 | Borepile Casting | 1593,22 | m3 | 5 | 1.741.765.633 |
| 7 | Soil Excavation | 2020,05 | m3 | 1 | 2.654.401 |
| 8 | Borepile Piece | 108,00 | Dots | 16 | 45.053.757 |
| **III** | **Pile cap Work** | | | | |
| 1 | Work Floor Casting | 71,67 | m3 | 1 | 64.488.367 |
| 2 | Pile Cap Reinforcement Fabrication | 135870,23 | kg | 2 | 2.056.493.993 |
| 3 | Pile cap Formwork Fabrication | 608,20 | m2 | 2 | 38.048.652 |
| 4 | Installation of Pile Cap Reinforcing | 135970,23 | kg | 4 | 15.692.251 |
| 5 | Installation of Pile Cap Formwork | 608,20 | m2 | 1 | 5.837.184 |
| 6 | Pile cap Casting | 2002,74 | m3 | 5 | 2.363.261.086 |
| 7 | Pile Cap Formwork Demolishing | 608,20 | m3 | 2 | 9.983.095 |
| **IV** | **Pillar Work** | | | | |
| 1 | Pier Reinforcement Fabrication | 303348,61 | kg | 2 | 4.588.665.160 |
| 2 | Pier Formwork Fabrication | 1159,60 | m3 | 4 | 73.439.831 |
| 4 | Installation of Pier Reinforcement | 303348,61 | kg | 12 | 94.153.508 |
| 5 | Installation of Pier Formwork | 1159,60 | m2 | 2 | 42.365.568 |
| 6 | Pier Casting | 891,47 | m3 | 2 | 1.093.735.458 |
| 7 | Demolishing Pier Formwork | 1159,60 | m3 | 5 | 24.957.737 |
| 9 | Landfill | 2020,05 | m3 | 1 | 2.546.401 |
| **V** | **Pierhead Work** | | | | |
| 1 | Pierhead Reinforcement Fabrication | 330393,94 | kg | 3 | 5.007.431.778 |
| 2 | Pierhead Formwork Fabrication | 1992,64 | m3 | 9 | 138.610.505 |
| 3 | Installation of Pierhead Reinforcement | 330393,94 | kg | 15 | 117.691.886 |
| 4 | Installation of Pierhead Formwork | 1992,64 | m3 | 5 | 124.136.819 |
| 5 | Pierhead Casting | 1324,95 | m3 | 3 | 1.626.721.225 |
| 6 | Demolishing Pierhead Formwork | 1992,64 | m3 | 8 | 39.932.379 |
| | UPPER STRUCTURE WORK | | | | |
| **VI** | **Pot Bearing Work** | | | | |
| 1 | Pot Bearing Reinforcement Fabrication | 2113,08 | kg | 1 | 34.860.760 |
| 2 | Pot Bearing Formwork Fabrication | 7,33 | m3 | 1 | 972.175 |
| 3 | Installation of Pot Bearing Reinforcement | 2113,08 | kg | 1 | 2.083.074 |
| 4 | Installation of Pot Bearing Formwork | 7,33 | m3 | 1 | 655.455 |
| 5 | Pot Bearing Casting | 1,88 | m3 | 1 | 12.621.357 |
| 6 | Demolishing Pot Bearing Formwork | 7,33 | m3 | 1 | 444.046 |
| 7 | Installation of Lead Rubber Bearing | 6,00 | unit | 1 | 47.105.574 |
| **VII** | **Box Girder Work** | | | | |
| 1 | Segment 1 Form Traveller Work | 4 | set | 3 | 1.115.292.695 |
| 2 | Segment 1 Box Girder Reinforcement Fabrication | 48078,52 | kg | 1 | 735.299.246 |
| 3 | Segment 1 Box Girder Formwork Fabrication | 947,07 | m2 | 4 | 64.259.113 |
| 4 | Installation of Segment 1 Box Girder Reinforcement | 48078,52 | kg | 3 | 23.538.377 |
| 5 | Installation of Segment 1 Box Girder Formwork | 947,07 | m2 | 3 | 17.511.551 |
| 6 | Segment 1 Box Girder Casting | 373,72 | m3 | 1 | 503.973.483 |
| 7 | Segment 1 Box Girder Curing | 947,07 | m2 | 2 | 3.973.861 |
| 8 | Stressing Segment 1 Box Girder | 2622 | strand | 3 | 124.748.150 |
| 9 | Demolishing Segment 1 Box Girder Formwork | 947,07 | m2 | 4 | 19.966.190 |
| 10 | Segment 2 Form Traveller Work | 4 | set | 3 | 1.069.292.685 |

Cycle Time (Ts1) = (T1+T2) x Fv = 25 minutes
Cap. Prod/hours (Q1) = (V x Fa x 60 )/Ts1 = 15,94 m³/hours
Tool Coefficient = 1: Q1 = 0,0628 hours
Concrete Vibrator
The production capacity of concrete vibrator is customized based on the production capacity of concrete pump
Cap. Prod/hours (Q2) = (V x Fa x 60 )/Ts2 = 15,94 m³/hours
Tools Coefficient = 1 : Q2 = 0,0628 hours

b. Casting Duration

$$\text{Duration} = \frac{Volume}{Concrete\ Pump\ Productivity\ x\ amount\ x\ Tk} = \frac{2002{,}74\ m^3}{15{,}94x\ 4\ x\ 7}$$

= 5 days

*D. The Calculation of Individual Worker Price*

On the Table 13 until **Table 22** shown the calculation of individual worker price

## CONCLUSIONS AND SUGGESTIONS

*A. Conclusions*

Based on the description and discussion of this Final Project, some conclusions can be drawn, those are as follows:

1. Implementation Method of the Cakung Fly Over Construction Project with the Balance Cantilever

Table 22. Continuation of Calculation of Cost and Duration Recapitulation

| No | Work Description | Volume | Unit Weight | Duration | Price |
|---|---|---|---|---|---|
| 11 | Segment 2 Box Girder Reinforcement Fabrication | 45900,26 | kg | 1 | 698.608.236 |
| 12 | Segment 2 Box Girder Formwork Fabrication | 916,07 | m2 | 4 | 62.920.183 |
| 13 | Installation of Segment 2 Box Girder Reinforcement | 45900,26 | kg | 2 | 15.692.251 |
| 14 | Installation of Segment 2 Box Girder Formwork | 916,07 | m2 | 3 | 17.511.551 |
| 15 | Segment 2 Box Girder Casting | 351,7 | m3 | 1 | 476.747.459 |
| 16 | Segment 2 Box Girder Curing | 916,07 | m2 | 2 | 3.744.762 |
| 17 | Segment 2 Box Girder Stressing | 2451 | strand | 3 | 118.244.210 |
| 18 | Demolishing Segment 2 Box Girder Formwork | 916,07 | m2 | 4 | 19.966.190 |
| 19 | Segment 3 Form Traveller Work | 4 | set | 3 | 1.115.292.685 |
| 20 | Segment 3 Box Girder Reinforcement Fabrication | 47770,73 | kg | 1 | 730.667.293 |
| 21 | Segment 3 Box Girder Formwork Fabrication | 992,51 | m2 | 5 | 72.059.336 |
| 22 | Installation of Segment 3 Box Girder Reinforcement | 47770,73 | kg | 2 | 15.692.251 |
| 23 | Installation of Segment 3 Box Girder Formwork | 992,51 | m2 | 3 | 17.511.551 |
| 24 | Segment 3 Box Girder Casting | 351,7 | m3 | 1 | 476.747.459 |
| 25 | Segment 3 Box Girder Curing | 992,51 | m2 | 2 | 3.894.202 |
| 26 | Segment 3 Box Girder Stressing | 2318 | strand | 3 | 113.185.590 |
| 27 | Demolishing Segment 3 Box Girder Formwork | 992,51 | m2 | 4 | 19.966.190 |
| 28 | Segment 4 Form Traveller Work | 4 | set | 3 | 1.069.292.685 |
| 29 | Segment 4 Box Girder Reinforcement Fabrication | 46795,41 | kg | 1 | 715.989.436 |
| 30 | Segment 4 Box Girder Formwork Fabrication | 969,23 | m2 | 4 | 65.216.529 |
| 31 | Installation of Segment 4 Box Girder Reinforcement | 46795,41 | kg | 2 | 15.692.251 |
| 32 | Installation of Segment 4 Box Girder Formwork | 969,23 | m2 | 3 | 17.511.551 |
| 33 | Segment 4 Box Girder Casting | 353,66 | m3 | 1 | 479.172.881 |
| 34 | Segment 4 Box Girder Curing | 969,23 | m2 | 2 | 3.848.689 |
| 35 | Segment 4 Box Girder Stressing | 2356 | strand | 3 | 114.630.910 |
| 36 | Demolishing Segment 4 Box Girder Formwork | 969,23 | m2 | 4 | 19.966.190 |
| 37 | Segment 5 Form Traveller Work | 4 | set | 3 | 1.207.292.685 |
| 38 | Segment 5 Box Girder Reinforcement Fabrication | 54392,47 | kg | 1 | 830.319.096 |
| 39 | Segment 5 Box Girder Formwork Fabrication | 1041,91 | m2 | 5 | 74.193.348 |
| 40 | Installation of Segment 5 Box Girder Reinforcement | 54392,47 | kg | 4 | 31.384.503 |
| 41 | Installation of Segment 5 Box Girder Formwork | 1041,91 | m2 | 3 | 17.511.551 |
| 42 | Segment 5 Box Girder Casting | 333,88 | m3 | 1 | 454.721.376 |
| 43 | Segment 5 Box Girder Curing | 1041,91 | m2 | 2 | 3.990.783 |
| 44 | Segment 5 Box Girder Stressing | 2280 | strand | 3 | 111.740.270 |
| 45 | Demolishing Segment 5 Box Girder Formwork | 1041,91 | m2 | 4 | 19.966.190 |
| 46 | Segment 6 Form Traveller Work | 4 | set | 3 | 1.207.292.685 |
| 47 | Segment 6 Box Girder Reinforcement Fabrication | 51944,06 | kg | 1 | 793.472.541 |
| 48 | Segment 6 Box Girder Formwork Fabrication | 1019,18 | m2 | 5 | 73.211.474 |
| 49 | Installation of Segment 6 Box Girder Reinforcement | 51944,06 | kg | 4 | 31.384.503 |
| 50 | Installation of Segment 6 Box Girder Formwork | 1019,18 | m2 | 3 | 17.511.551 |
| 51 | Segment 6 Box Girder Casting | 358,35 | m3 | 1 | 484.966.980 |
| 52 | Segment 6 Box Girder Curing | 1019,18 | m2 | 2 | 3.946.345 |
| 53 | Segment 6 Box Girder Stressing | 2318 | strand | 3 | 113.185.590 |
| 54 | Demolishing Segment 6 Box Girder Formwork | 1019,18 | m2 | 4 | 19.966.190 |
| 55 | Segment 7 Form Traveller Work | 4 | set | 3 | 1.207.292.685 |
| 56 | Segment 7 Box Girder Reinforcement Fabrication | 56910,27 | kg | 1 | 868.210.013 |
| 57 | Segment 7 Box Girder Formwork Fabrication | 998,44 | m2 | 5 | 72.315.225 |
| 58 | Installation of Segment 7 Box Girder Reinforcement | 335,62 | kg | 4 | 31.384.503 |
| 59 | Installation of Segment 7 Box Girder Formwork | 998,44 | m2 | 3 | 17.511.551 |
| 60 | Segment 7 Box Girder Casting | 335,62 | m3 | 1 | 456.689.925 |
| 61 | Segment 7 Box Girder Curing | 998,44 | m2 | 2 | 3.905.783 |
| 62 | Segment 7 Box Girder Stressing | 2508 | strand | 3 | 120.412.190 |
| 63 | Demolishing Segment 7 Box Girder Formwork | 998,44 | m2 | 4 | 19.966.190 |
| 64 | Segment 8 Form Traveller Work | 4 | set | 3 | 1.207.292.685 |
| 65 | Segment 8 Box Girder Reinforcement Fabrication | 53024,26 | kg | 1 | 809.728.579 |
| 66 | Segment 8 Box Girder Formwork Fabrication | 981,19 | m2 | 5 | 71.570.347 |
| 67 | Segment 8 Box Girder Reinforcement Fabrication | 53024,26 | kg | 4 | 31.384.503 |

Method for the Box Girder work carried out by 4 groups of workers on several main structural works. For the Box Girder work using the Traveler Form, it is divided into 8 segments consisting of 4 box girder segments for each segment which is done in sequences.

2. The target time for completing the project exceeds the time limit of the project time planning, namely for 6 months.
3. From the description of the implementation and scheduling methods that have been planned, it is obtained that the duration of the structural work of the Cakung Fly Over Development Project with the Balance Cantilever Method on the Box Girder work on the preparation work was completed within 5 days. On the upper and lower structure work was completed within 304 days. Assuming that on Saturday and Sunday is a normal working hours which is not counted as overtime, namely 7 hours of work per day. starting at 08.00-16.00 and 1 hour break at 12.00-13.00.
4. The implementation costs required in the Cakung Fly Over Development Project with the Balance Cantilever Method on the Box Girder work with the attached work details.
5. These costs do not include indirect costs and general OSH costs. In this Final Project, it is assumed that indirect OSH costs are 2.5% of the total structure cost so that an indirect OSH cost value of Rp. 1,038,352,979, and on the same time a total

Tabel 22. Continuation of Calculation of Cost and Duration Recapitulation

| No | Work Description | Volume | Unit Weight | Duration | Price |
|---|---|---|---|---|---|
| 68 | Installation of Segment 8 Box Girder Formwork | 981,19 | m2 | 3 | 17.511.551 |
| 69 | Segment 8 Box Girder Casting | 321,74 | m3 | 1 | 439.714.790 |
| 70 | Segment 8 Box Girder Curing | 981,19 | m2 | 2 | 3.872.071 |
| 71 | Segment 8 Box Girder Stressing | 2622 | strand | 3 | 124.748.150 |
| 72 | Demolishing Segment 8 Box Girder Formwork | 981,19 | m2 | 4 | 19.966.190 |
| 73 | Middle Closure Traveller Form Work | 4 | set | 3 | 563.292.685 |
| 74 | Segment Middle Closure Reinforcement Fabrication | 8749 | kg | 1 | 143.421.577 |
| 75 | Segment Middle Closure Formwork Fabrication | 161,9 | m2 | 1 | 12.830.614 |
| 76 | Installation of Segment Middle Closure Reinforcement | 8749 | kg | 2 | 15.692.251 |
| 77 | Installation of Segment Middle Closure Formwork | 161,9 | m2 | 1 | 5.837.184 |
| 78 | Segment Middle Closure Casting | 51,92 | m3 | 1 | 106.152.406 |
| 79 | Segment Middle Closure Curing | 161,9 | m2 | 1 | 1.868.428 |
| 80 | Segment Middle Closure Stressing | 326,04 | strand | 1 | 20.741.202 |
| 81 | Demolishing Segment Middle Closure Formwork | 161,9 | m2 | 1 | 4.991.547 |
| 82 | Segment Closure P7 Reinforcement Fabrication | 27395,87 | m2 | 2 | 435.798.012 |
| 83 | Segment Closure P7 Formwork Fabrication | 506,95 | kg | 3 | 39.410.173 |
| 84 | Installation of Segment Closure P7 Reinforcement | 27395,87 | m2 | 7 | 54.922.880 |
| 85 | Installation of Segment Closure P7 Formwork | 506,95 | m3 | 2 | 11.674.368 |
| 86 | Segment Closure P7 Casting | 162,59 | m2 | 1 | 242.960.946 |
| 87 | Segment Closure P7 Curing | 506,95 | strand | 1 | 2.543.006 |
| 88 | Segment Closure P7 Stressing | 942,4 | m2 | 2 | 52.524.649 |
| 89 | Demolishing Segment Closure P7 Formwork | 506,95 | m2 | 2 | 9.983.095 |
| 90 | Segment Closure P10 Reinforcement Fabrication | 28868,76 | kg | 2 | 457.963.914 |
| 91 | Segment Closure P10 Formwork Fabrication | 534,2 | m2 | 3 | 40.587.518 |
| 92 | Installation of Segment Closure P10 Reinforcement | 28868,76 | m3 | 7 | 54.922.880 |
| 93 | Installation of Segment Closure P10 Formwork | 534,2 | m2 | 2 | 11.674.368 |
| 94 | Segment Closure P10 Casting | 171,33 | strand | 1 | 253.767.308 |
| 95 | Segment Closure P10 Curing | 534,2 | m2 | 1 | 2.596.290 |
| 96 | Segment Closure P10 Stressing | 1075,82 | strand | 2 | 57.599.328 |
| 97 | Demolishing Segment Closure P10 Formwork | 534,2 | m2 | 2 | 9.983.095 |
| Total Cost (Includes Tax) | | | | | 51.917.648.940 |
| Indirect Cost K3 (2,5%) | | | | | 1.038.352.979 |
| Total Cost | | | | | 51.956.001.919 |

implementation cost of Rp. 51,956,001,919 including 15% tax and project overhead costs.

*B. Suggestions*

The suggestions that can be given by the author on this final project are as follows:

1. More detailed prices are still needed so that the result of the cost calculation are not very different from the actual costs.
2. The need for a target time to complete the construction project in order to determine the right working method and a sufficient number of workers so that the project can be completed on time.
3. The need for references to previous research in order to determine the implementation method to be used, so that the calculation of duration and costs can obtain optimal results.

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