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Calculation of Cost Budget Plan and Development of Implementation Method on Preservation of Aceh Selatan/Subulussalam Boundary Road - Sumut Province Boundaries

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- **ABSTRACT**

Cost Budget Plan is a calculation of the amount of money needed for materials, tools and wages, as well as other costs related to project implementation. Goals to be achieved to recalculate the budget Road Reconstruction Workand the method of implementation in which there are work methods for tools, K3, quality control, and the S curve regarding cost, quality and the right time. The results obtained from the calculation, Preservation Reconstruction of the South Aceh Boundary Road / Subulussalam -Boundaries of North Sumatra Province The total budget cost is Rp. 3.412.934.913.00 As well as scheduling the implementation time using the S curve. The preparation of the Implementation method applied to the Project includes Ordinary Excavation, Asphalt Pavement Excavation without Cold Milling Machine, Grain Pavement Excavation, Selected Piles from excavation sources, Road Body Preparation, Grade Aggregate Foundation Layer A, Class B Aggregate Base Layer, Binder Impregnating Layer - Liquid/Emulsion Asphalt, Binder Impregnating Layer - Liquid/Emulsion Asphalt, Laston Wear Layer (AC-WC), Laston Intermediate Layer (AC-BC), Laston Foundation Layer (AC- base), Anti-flaking agent, Thermoplastic Road Marking, Hot Mix Asphalt Improvement, and Plant Control. in an effective way based on the plans.

Keywords: *Cost Budget, S Curve, Implementation Method*

1. PRELIMINARY

The road project used as the object of this thesis review is Implementation of National Road Preservation Region II Aceh Province South Aceh/Subulussalam Boundary Road – North Sumatra Province Boundary. At this writing the author wants to plan a budget only for road reconstruction work that has a road length of 300 m, with a total price of Rp. 3,609,247,250.00. (three billion six hundred nine million two hundred forty seven thousand two hundred and fifty rupiah) and also create an effective and efficient implementation method.The Implementation Method is a construction project management mechanism so that time performance does not experience delays. So that management in managing project implementation methods is highly prioritized in a project implementation. Making The implementation method that the researcher wants to review uses the 2018 Bina Marga Technical Specifications.

According to Bachtiar (1993) the budget is a calculation of the amount of money needed for materials and wages, as well as other costs related to the implementation of the building or project. According to Ahmad Kholil (2012), the use of heavy equipment for civil engineering pavement work is on buildings, roads, water structures such as dams, weirs, irrigation and others. Heavy equipment is used in Civil Engineering to help humans in relatively large and complicated jobs. By using heavy equipment, the resulting work productivity is greater and faster.

According to Rostiyanti, FS (2002), heavy equipment is used to assist humans in carrying out construction work of a building structure. Currently heavy equipment is an important factor in a project. The purpose of using heavy equipment is to make it easier for humans to do large-scale work so that the expected results can be achieved more easily in a relatively shorter time. Tool productivity depends on tool capacity, tool cycle time, and tool efficiency.

According to Bina Marga (2016), the coefficient of heavy equipment is the time required (in hours) by a heavy equipment to complete or produce production of one unit volume of type of worker.

According to 2016 Unit Price Analysis (AHSP 2016), to calculate the productivity of the Wheel Loader the formula can be used:

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

Information:
Q = Wheel Loader Productivity (m3/ hour)
V =Bucket capacity
Facebook =Bucket factor
Fa =Tool efficiency factor
Ts =Cycle Time (loading etc.), (0.45 minutes)
V1 =Loaded average speed (15- 25) km/h
V2 =Average empty return speed (25-35) km/hour
T1 = Travel time for contents = (L/ V1) x 60 minutes
T2 = Empty travel time = (L/ V2) x 60 minutes

According to AHSP 2016, to calculate the productivity of the Dump Truck can be used the formula:

$$Q = \frac{Vx \; Fa \; x \; 60}{D \; x \; Ts}$$

Information:
Q = Dump Truck Productivity (m3/hour)
V = Tank capacity (tons)
Fa = Tool Efficiency Factor
Fk = material expansion factor
D = Weight of material (loose, loose) (tonnes/m3)
V1 = Average loaded speed, km/h.
V2 = Average empty speed, km/hour
Ts = Cycle Time
T1 = Load time (vx 60 / D x Qexc) (minutes)
T2 = Content travel time =(L/V1) x 60 min
T3 = Empty travel time = (L / V2) x 60 minutes
T4 = Other times,minute
L = Quarry distance to project location (km)

According to AHSP 2016, to calculate Motor Grader productivity, the formula can be used:

$$Q = \frac{Lh \; x \; (N \; (\; b \; - bo \;) + \; bo \;) \; x \; Fa \; x \; 60}{N \; x \; n \; x \; Ts}$$

Information:
Q = Motor Grader Productivity (m3/hour)
Lh = Length of stretch (m)
b = Effective blade width, (m)
T1 = Time for 1 pass = (Lh x 60) / (vx 1000), (minutes)
T2 = others, (minutes)
Fa = Tool efficiency factor
V = Average speed
Ts = Cycle time
N = Number of passes
N = Amount of stripping per pass, times pass

t = Layer thickness
bo = Overlap width (m)

The production capacity of the loading and hauling equipment is very influential on the production target that has been targeted by the company. Therefore, the selection of loading and digging patterns is carried out to optimize the performance of the loading equipment. The production capacity of the dig-loading equipment can be calculated by the following formula:

$$P = \frac{60x\ Cb\ x\ Ff\ x\ Ek\ x\ Sf}{Ctm}$$

Information:

P = Production of loading equipment, (BCM/hour)
Ctm = Loader cycle time, (minutes)
Cb = Capacity*bucket*, (m3)
ff = *Bucket Fill Factor*, (%)
Oak = work efficiency, (%)
SF = Swell factor

The production capacity of the conveyance can be calculated using the following formula:

$$P = \frac{60\ xnx\ Cb\ x\ Fb\ x\ N\ x\ Ek\ x\ Sf}{CTa}$$

Information:
P = Production of means of conveyance, (BCM/hour)
CTa = Circulation time of the conveyance, (minute)
Cb = Capacity*bucket*, (m3)
N = The amount of bulk
Facebook = *Bucket Fill Factor*, (%)
Oak = work efficiency, (%)
N = Number of means of conveyance, (unit)
SF = *Swell Factor*

There are several project scheduling methods used to manage project time and resources. Each method has advantages and disadvantages. Consideration of the use of these methods is based on the needs and results to be achieved on scheduling performance. There are several implementation scheduling methods, namely: block charts, vector diagrams, network planning, etc. In this implementation scheduling method the author uses the block chart method.

According to Ervianto (2003), a Bart chart is a list of activities arranged in a vertical column, while the horizontal direction column shows the time scale. When the start and end of an activity can be seen clearly while the duration of the activity shows the length of the bar chart.

A work progress curve is also known as an S-curve, graphically presents several cumulative measurements on the vertical axis against time on the horizontal axis. This progress can be measured by the amount of value issued.The S-curve is a curve that is structured to show the relationship between the cumulative value of costs or man hours that have been used or the percentage (%) of work completion against time. Thus the S-curve can describe the progress of the volume of work completed throughout the course of the project or work in part of the project. By comparing the curve with a similar curve prepared based on the plan, it will be immediately clear when deviations occur. Because of its reliable ability to see irregularities in project implementation, project control using the S-Curve is often used in project control. On the S–Curve, the horizontal axis represents calendar time,

2. LITERATURE REVIEW

To analyze cost control on a project, supporting data is needed, such as reference books related to the plan. In this case, secondary data is also needed in the form of Shop Drawings, Wage Data, Materials and Equipment, Weekly Reports, and Implementation Time Schedule. These data were obtained from the implementing contractor, namely PT. Sari Bumi Prima.

At the work stage, sufficient data is usually obtained regarding all aspects deemed necessary so that steps can be taken towards determining implementation policies and preparing detailed work plans. Activities that need to be carried out to prepare a plan include research on plans and specifications, more accurate calculations of the amount of work and volume of work.

In planning this thesis the author will read the drawings and understand and understand the information provided by the working drawings so that they can be embodied in the objects being produced.

- This volume calculation stage can be carried out based on the floor plan and detail drawings, so that if these drawings have unclear dimensions or drawings and affect the calculation of the volume of work.
- fee onScope of Work for Mesh Reconstructionobtained by recalculating costs using other analytical methods, from unit prices (wages, materials, tools), then multiplied by work time.
- Material costs must be measured by weight and other measurements as needed. A good material control method leads to higher efficiency through selection in accordance with the planning and sufficient level of supply so that the material requirements will be able to run properly.
- Calculating Equipment Costs In calculating the cost of carrying out work using heavy equipment, it is very necessary to know the main costs of this need. The cost of equipment is the cost for calculating the rental price of the equipment that will be used to complete a job and according to the type of each job. The method of operating the equipment greatly affects the speed and ability to work, the quality of the work and in turn affects the project cost. Time Calculation

Barchartis a set of lists of activities arranged in a vertical column, while the horizontal direction column shows the time scale.

The preparation process of the bar chart (Bar Chart) is carried out with the following steps: List of work items, activities that contain all types of work activities that are in the development implementation plan, Sequence of work, from the list of activity items the sequence of work implementation is arranged simultaneously, and The time of execution of the work, is the period when the implementation of all activities ends.

The method for preparing the schedule and the S-curve is comparably using the Microsoft excel application by inputting data such as job descriptions, work unit prices and work weight percent. However, before compiling the S-curve schedule, the duration of the work is known as explained in sub-chapter (2.13).

The preparation of the S-curve in construction work is carried out in the following steps:

- The first step is to estimate the execution time of each job.
- The second step is to divide the weight of the work by the duration and then put it in the day of implementation column.
- Next, draw the S-curve according to the weight presentation number according to the computer using Microsoft Excel.
- Calculate the cumulative weight from start to finish of the project until it reaches 100%

3. DATA AND METHOD

Based on analysisplanbudget with calculations using the 2016 AHSP Analysis, the results of the cost calculation obtained inReconstruction workImplementation of National Road Preservation for Region II Aceh Province South Aceh/Subulussalam Boundary Road – North Sumatra Province Boundary, which is Rp. 3,412,934,913.00. (Three

Billion Four Hundred Twelve Million Nine Hundred Thirty Four Thousand Nine Hundred). While the result of the contractor's calculation is IDR 3,609,247,250.00. (Three billion six hundred nine million two hundred and forty seven thousand nine hundred) The difference in this writing with the contractor's calculation is IDR 196,312.337, - which is more expensive than the contractor's calculation.

The method of implementation carried out for each work carried out on the Reconstruction of the South Aceh / Subulussalam Boundary road - North Sumatra Province Boundary.

A. Ordinary Excavation Work

Before excavation is carried out, measurements and installation and elevation are carried out at the work location. Before the excavation work begins, an inspection of the condition of the equipment, personal protective equipment (safety shoes, helmet), signs along with traffic control officers is equipped with a red flag and all must be prepared in advance. Excavation work is usually carried out from STA 10+710 to STA 11+010 meters and the road width is 10.50 meters, with a volume of worknormal excavation of 195.10 M3.yesm effective work is carried out for 7 hours of normal work, normal working hours start from 08.00 s / d 17.00.Excavation work is carried out using an excavator starting at the lowest elevation first and then the excavation results are disposed of outside the work location according to the instructions of the Board of Directors. In the next stage, a group of workers will tidy up the excavated results and the excavation will be dumped into a dump truck and the dump truck will throw the excavated material off the site. The disposal location at Base Camp is at Sta STA 26 +500 . The distance between the Base Camp to the project site is 15,790 km.

B. Excavation of Asphalt Pavement without Cold Milling Machine

Making marks/marking on existing pavement locations to be demolished/excavated. The existing surface of the marked pavement is cut using a machine. Existing surface that has been cut, demolished or excavated using a jack hammer. Dismantled with trim the rest of the excavation must be cut perpendicularly. Asphalt excavated results are loaded into trucks and dumped outside the work site. Existing surfaces that have been completely dismantled are measured together with service providers, supervisors and service users. And poured into the work inspection minutes. During the excavation work the contractor will place officers to regulate traffic at least two people at the work location, as well as install signs around the work location.

Pavement Excavation WorkAsphalt without Cold Milling Machinecarried out from STA 10+720 to STA 11+000 meters and road widths varying from 10.50 meters, with a volume of workgrained pavement excavation of 176.75 M3.yesm effective work is carried out for 7 hours of normal work, normal working hours start from 08.00 s / d 17.00.This granular pavement is generally demolished as a road pavement. Disassembly is done with a Jack Hammer and ganco then manually loaded into the truck with a shovel. The Dump Truck dumps the excavated material outside the work location or according to the orders of the Board of Directors.

C. Grained Pavement Excavation Work

Prepare working drawings together with the Board of Directors Before excavation is carried out, measurements and installation and elevation are carried out at the work location. Before the excavation work begins, an inspection of the condition of the equipment, personal protective equipment (safety shoes, helmet), signs along with traffic control officers is accompanied by a red flag and all must be prepared in advance. Grain Pavement Excavation work is carried out from STA 10+835 to STA 10+935 meters and the road width varies 10.50 meters, with a volume of workgrained pavement excavation of 176.75 M3.yesm effective work is carried out for 7 hours of normal work, normal working hours start from 08.00 s / d 17.00.This granular pavement is generally demolished as a road pavement. Disassembly is done with a Jack Hammer and ganco then manually loaded into the truck with a shovel. The Dump Truck dumps the excavated material outside the work location or according to the orders of the Board of Directors.

D. Selected Stockpiling Work from Excavated Sources

Selected stockpiles from excavated sources are stockpiling works where stockpiles are taken from quarrys that meet the technical requirements and have been approved by the directors to become selected stockpiles. Selected stockpiles from excavated sources which are classified as selected stockpiles must consist of excavated materials approved by the site director. Selected piles from excavated sources may not be placed, spread or compacted when it rains, and compaction may not be carried out after rain or when the moisture content of the material is outside the specified range. The entire exposed surface of the final embankment shall be sufficiently level and shall have sufficient slope to ensure free run-off of

the surface. In this selected embankment work, it is planned with road lengths ranging from STA 10+710 to STA 11+010 meters and a road width of 10.50 meters, with a selected embankment volume of 2,759.07 M3. Selected embankment work from excavation sourcesjarak average from the Base Camp to the project site is 15.40 Km., with the volume of workstockpiles of choice from excavated sourcesof 176.75 M3.yesm effective work is carried out for 7 hours of normal work without overtime hours, starting from 08.00 to 17.00, the proportion of the aggregate mixture is in accordance with the mixture of the test job mix formula.

E. Class A Aggregate Layer

For the implementation of class A aggregate foundation layer work, it is carried out after the road body preparation work has been completed and has been approved by the field Directors. This work must include procuring, processing, transporting the spread, wetting and compacting the graded aggregate (crushed stone) according to predetermined specifications. The implementation is carried out on a surface that has been prepared and has been received in accordance with the details shown in the drawings or as ordered by the Technical Director. The surface of the Aggregate Base Layer must not be uneven which can accommodate water (puddles). The minimum thickness for the Aggregate Foundation layer is not less than the required thickness. Aggregate Base Layer Material must be selected according to the technical specifications. In this class A Aggregate Foundation Layer work is planned with road lengths ranging from STA 10+710 to STA 11+010 meters and road widths varying (3 meters to 10.5 meters) with a volume of Base Course work of 208 .51 M3. Upper foundation layer work (Base Course),jarak average from Base Camp to project site is 15 Km, solid aggregate layer thickness is 0.20 cm, effective working hours are carried out for 7 working hours normally no overtime hours, starting from 08.00 to 17.00, the proportion of aggregate mixture according to the mix of the test job mix formula.

F. Class B Aggregate Layer

For the implementation of class B aggregate foundation layer work, it is carried out after the road body preparation work has been completed and has been approved by the field Directors. Class B Aggregate foundation layer is for Lower foundation layer. Subbase course work is part of the pavement layer which is located between the base course and the selected embankment layer. The subbase course is planned with road lengths ranging from STA 10+710 to STA 11+010 meters and varying road widths (3 meters to 7 meters) with a subbase course volume of 186.75 M3. . Lower foundation layer work (SubBase Course) average from the Base Camp to the project site is 15 Km, the thickness of the solid aggregate layer is 0.20 M, effective working hours are carried out for 7 working hours normally no overtime starts from 08.00 to 17.00, the proportion of aggregate mixture according to with a mixture of test job mix formula.

G. Adhesive Coating - Liquid Asphalt / Emulsion

The binder layer is the work of sprinkling a mixture of bulk asphalt and kerosene 77-23 which has been mixed at high temperature in a heating tank at the AMP. The sprinkling of this adhesive layer is intended to provide a basic bond between the surface of the AC-BC/Asphalt layer and the AC-WC wear layer. Before sowing, the condition of the Asphalt or Laston Surface – Layer Between AC – BC must be seen. This sowing/spreading is carried out in Sunny Weather conditions. . Liquid Asphalt/Elmulsion Adhesive Coating work is planned with road lengths ranging from STA 10+710 to STA 11+010 meters and road widths varying (3 meters to 10.50 meters) with a Prime Coating work volume of 1,102.50 Liter. Bonding layer or Prime Coat workjarak the average distance from the Base Camp to the project site is 15 Km, the thickness of the spraying layer0.80 Liters/M2,yesm effective work is carried out for 7 hours of normal work without overtime hours, starting from 08.00 to 17.00, the proportion of the aggregate mixture is in accordance with the mixture of the test job mix formula.

H. Intermediate Layer Laston (AC – BC)

PerThis Asphalt Concrete Binder Course (AC-BC) work is the spread of hot asphalt mixture from the Asphalt Mixing Plant (AMP)This layer in the asphalt pavement structure is categorized as an intermediate layer in the layer between the wear layer (AC-WC) and base layer (AC-BASE).prthe proportion of aggregate mix according to the mix of the test job mix. The length of the asphalt work stretch starts from STA 10+710 to STA 11+010 meters and the road width varies (3 meters to 10.50 meters) with the Asphalt Concrete Binder Course (AC-BC) work volume of 434.70 tonnes. The average distance from the Asphalt Mixing Plant (AMP) to the project site is 15 Km, the thickness of the dense asphalt layer is 0.06 M done according to the plan drawings, effective working hours are carried out for 7 working hours normally there is no overtime, starting from 08.00 to 17.00, the proportion of the aggregate mixture is in accordance with the mixture of the test job mix. The tools used for Asphalt (AC-BC) work are: Wheel Loader, Asphalt Mixing Plant (AMP), Generator Set (Genset), Dump Truck, Asphalt Finisher, Tandem Roller, and Pneumatic Tire Roller.

I. Application of Laston AC Base Layer

Upper Laston or top foundation layer (AC-Base) is a pavement foundation consisting of a mixture of aggregate and asphalt with a certain ratio mixed and compacted in hot conditions. This layer is located under the binder layer (AC-BC), the pavement is not directly related to the weather, but it needs to have stability to withstand the traffic loads that are spread through the vehicle wheels. The foundation layer (AC-base) functions to provide surface layer support, reduce strain and stress, spread and transmit the load of the road construction below it (sub grade).

. Laston AC Base layer work is planned with road lengths ranging from STA 10+710 to STA 11+010 meters and varying road widths (3 meters to 10.50 meters) with a prime coat work volume of 1,102.50 liters. Bonding layer or Prime Coat workjarak the average distance from the Base Camp to the project site is 15 Km, the thickness of the spraying layer0.80 Liters/M2,yesm effective work is carried out for 7 hours of normal work without overtime hours, starting from 08.00 to 17.00, the proportion of the aggregate mixture is in accordance with the mixture of the test job mix formula.

J. Anti-flaking agent

Anti-Slacking Additive Work this work is added in liquid form into the aggregate mixture using a dozing pump during the wet mixing process in the pugmil. The quantity of anti-stripping additives used in the range of 0.2% - 0.3% by weight of Asphalt. The type of additive used that has been approved by the directors.

K. Medium Quality Concrete fc'20 Mpa

This work is carried out after the supporting work has been completed, such as installing formwork, assembling reinforcing steel and providing the required materials such as: cement, concrete sand, coarse aggregate (crushed stone/gravel) and water including equipment used for casting work, namely mixers, tools containers, stirrers and others that support the casting work. The working process begins with mixing cement, concrete sand, crushed stone/gravel and water mixed and stirred into concrete using a concrete mixer with the aim of obtaining a homogeneous mixture and meeting the desired standards as contained in the specifications. Then the concrete is cast into the prepared formwork and to get good casting results, Cast concrete must be compacted using a concrete vibrator. The purpose of vibration is to prevent air cavities in the concrete so as to produce maximum concrete strength.

L. Plain Reinforcing Steel-BjTP 280

Provide reinforcing steel whose diameter is in accordance with the structure/dimensional request (shown in the bar on the structural plan drawings), then measure the length of the reinforcing steel to be cut, after cutting it is continued with the bending of the steel, the size as stated in the list.

After the bending of the reinforcing steel is completed, the assembly of the reinforcing steel is carried out on the formwork that has been prepared beforehand, the arrangement of the reinforcing steel is in accordance with the bar list and instructions from the owner, the reinforcing steel binders use concrete wire so that the arrangement of the reinforcing steel does not change

M. Thermoplastic Road Markings

This work is the final stage of work carried out after the coating Asphalt pavement and over lay finish. The type and type of markings to be painted on the asphalt surface layer refer to the implementation drawings or on the orders of the Site Directors

N. Plant Control

Vegetation control must be finished trimmed or cut according to the provisions no later than 7 days, free of vegetation around the ends of culverts, canals, hardened waterways, curbs, around traffic signs, guardrails, guideposts, poles lights, shoulders, all whitewashed surfaces, islands for traffic,buildings under the bridge and the edge of the bridge deck.

4. RESULTS AND DISCUSSION

From the results of the calculation of the budget plan, the following conclusions are obtained: The total amount of the budget forPublic Works, Earthworks and Geosynthetics, Grained Concrete and Cement Pavement Works, Asphalt Pavements, Structures, Daily Work and Other Work, and Maintenance Workamounting to Rp. With the following details: Public Works amounting to Rp.435,320,836.34. Earthworks and Geosynthetics amounting to Rp.476,612,268.85. Grained Pavement Work of IDR 146,416,573.32. Asphalt work of IDR 535,740,359.74. Structure work of IDR 785,368,638.46. Daily Work and Other Work Rp.47,797,218.54. Performance Maintenance Work of IDR 675,412,207.42. The implementation method is a measurable work program, a way of working to implement a job, applying a measurable budget for implementation, in which there are work methods for tools, K3, quality control, and the S curve relating to cost, quality and time.

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