Strategy for Accelerating Completion of Remaining Bridge Construction Project Work Using the Critical Path Method (Study on the Overvass Road Kilometer 2 Bridge Construction Project Owned by PT Banuang Mitra Bersama)

Husnul Khatimah

Civil Engineering, Universal Institute of Professional Management

Abstract

PT. Binuang Mitra Bersama company engaged in coal mining. The company is carrying out the construction work of the overpass haul road bridge Km. 2 on the trase or national road section at Simpang Marabahan, Margasari, Tapin Regency, South Kalimantan Province. The construction of the Overpass Bridge is funded by the corporate social responsibility (CSR) of PT. Binuang Mitra Bersama and as a consequence of the hauling road crossing the national road. Litas permits with the Ministry of Public Works and Public Housing are one year, starting from June 2017 to July 2018. During the process of implementing the bridge construction overpasses several problems arise. First, the position of the land for the retaining wall and the gravity wall for the construction of the bridge's concrete retaining wall in Banjarmasin at the residents' complaint. Second, the work process for installing bridge erection girder has instructions from the Ministry of Public Works and Public Housing on 20 February 2018 to temporarily stop the work. In this study the technique or strategy of accelerating the completion of work with network diagrams Precedence Diagram Method (PDM), which makes work activities based on job design drawings, makes logic by simplifying each stage of work activities for the purpose of each work activity can be divided and made groups working group, making parts of work activities and working groups so that the composition and number of activities are seen and the linkages or dependencies include. After the Precedence Diagram Method (PDM) network is created, the critical trajectory is analyzed, the activities included in the critical trajectory are made accelerated in critical trajectory activities with acceleration in critical trajectory activities or rescheduling. The results of the study are as follows; first, the delay factor is caused by internal factors, the temporary suspension of installation of girder (erection girder) and the duration of time to 261 (two hundred and sixty one) calendar days exceeding the duration of the contract 240 (two hundred and forty) calendar days and replacement of land and building a house on the land. Second, to simplify the settlement of the job using the Precedence Diagram Method (PDM) work network diagram method. The three techniques or strategies for accelerating the completion of work by accelerating (rescheduling) critical paths on the Precedence Diagram Method (PDM) diagram with the duration of the results being 231 (two hundred thirty one) calendar days and cost efficiency of Rp. 14,550,000, 00.

Keywords: Delay, Precedence diagram method, Crash program, Time duration, Cost.

INTRODUCTION

PT. Binuang Mitra Bersama company engaged in coal mining. The company is carrying out the construction work of the overpass haul road bridge Km. 2 on the trase or national road section at Simpang Marabahan, Margasari, Tapin Regency, South Kalimantan Province. The location of the overpass bridge construction itself belongs to the Directorate General of Highways, Specific Non-Vertical Work Units of South Kalimantan Road and Bridge Construction Region II of South Kalimantan Province, Central Kalimantan Region XI National Road Implementation Center, Ministry of Public Works and Public Housing.

The construction of the Overpass Bridge is funded by the corporate social responsibility (CSR) of PT. Binuang Mitra Bersama and as a consequence of the hauling road crossing the national road. Litas permits with the Ministry of Public Works and Public Housing are one year, starting from June 2017 to July 2018. During the process of implementing the bridge construction overpasses several problems arise. First, the position of the land for the retaining wall and the gravity wall for the construction of the bridge's concrete retaining wall in Banjarmasin at the residents' complaint. Second, the work process for installing bridge erection girder has instructions from the Ministry of Public Works and Public Housing on 20 February 2018 to temporarily stop the work.

While the duration of running time is 124 (one hundred and twenty four) days of calendar and the remaining duration of contract time is very urgent, which is for 116 (one hundred and sixteen) calendar days. With the postponement of the postponement of the girder installation activities for 21 (twenty one) days, it is certain that the completion of all work will exceed the completion period of 21 days. For this reason, action must be taken to deal with this delay with the methods of studying the causes of the delay in the related standard methods.

In this study the technique or strategy of accelerating the completion of work with network diagrams Precedence Diagram Method (PDM), which makes work activities based on job design drawings, makes logic by simplifying each stage of work activities for the purpose of each work activity can be divided and made groups working group, making parts of work activities and working group groups so that the composition and number of activities are seen and the linkages or dependencies include. After the Precedence Diagram Method (PDM) network is created, the critical trajectory is analyzed, the activities included in the critical trajectory are made accelerated in critical trajectory activities with acceleration in critical trajectory activities or rescheduling.

Based on the above problems, the purpose of this research is as follows; The first is to study the factors that cause delays in the construction of bridges overpass haul road km. 2 belongs to PT. Binuang Mitra Bersama and secondly is to form an approach to handling delays in completing the work.

THEORITICAL REVIEW

In each construction project there are various activities carried out by the people involved in the project itself. According to Suharto (1995), activities can be interpreted as a temporary activity that takes place in a limited period of time, with the allocation of certain funding sources and is intended to carry out tasks

whose goals have been outlined clearly. Many activities and parties involved in implementing construction projects pose many complex problems.

Problems faced in the process of implementing construction in general can be classified into two. The first is a group of problems that deal with the success of the efforts that must be carried out, where there are interdependencies and close influence between the factors of cost, time and quality or quality. As is known, the implementation of construction is always intended to produce a quality building with non-wasteful financing, and all of them must be able to be realized in a limited time span given the large investment costs that must be invested.

While the second problem group, is a problem related to efforts to achieve good construction, which is related to coordination and control activities for all management functions. In accordance with its natural state, the mechanism of the construction process involves many elements of construction, since the assignor or owner as the initiator, consultants, contractors as builders. Material suppliers, up to construction workers. Their respective activities are scattered, fragmented, and separated from each other according to their professional groups. For example, a blacksmith who happens to be absent from work for example, cannot be replaced by carpenters or other artisan professions. Even in carrying out activities or work, they are grouped separately from each other according to their individual needs for equipment, materials, work methods and so on.

According to Proboyo (1999), the delay in project implementation generally always has adverse consequences for both the owner and the contractor, because the impact of delay is conflict and debate about what and who is the cause, also the demands of time and added costs. The definition of delay according to Ervianto (2005) is as a time of implementation that cannot be utilized in accordance with the plan of activity, causing one or several activities to follow to be delayed or not completed according to the planned schedule.

According to Husein (2003), project scheduling is one of the elements of planning results, which can provide information about the project plan and progress schedule in terms of performance of resources in the form of costs, labor, equipment and materials and project duration plans and time progress for project completion. In the process of scheduling, the preparation of activities and relationships between activities is made more detailed and very detailed. This is intended to assist in the implementation of project evaluations. Scheduling or scheduling is the allocation of time available to carry out each work in order to complete a project until optimal results are achieved by considering the limitations that exist.

According to Andry, the PDM method is a network that includes the classification of Activity On Node (AON). Here activities are written in nodes which are generally rectangular, while arrows are only a guide to the relationship between the activities in question. The PDM is also known as a constraint (sign). One constraint can only connect two nodes, because each node has two ends, that is the beginning or beginning = (S) and the end or end = (F). So here there are four types of constraints, that is:
1. Constructions completed to start - Finish to Start (FS) This construct provides an explanation of the relationship between the start of an activity and the completion of the previous activity. Formulated as FS (i-j) = a which means the activity (j) starts a day, after the activities preceding it (i) are completed.

The project always wants the number a to be equal to 0 except when certain things are found, for example: Climate consequences that cannot be prevented, chemical or physical processes such as the time of drying of mortar and managing permits.

2. Constraints start to start - Start to Start (SS) Provide an explanation of the relationship between the start of an activity and the start of the previous activity. Or SS (i-j) = b which means an activity (j) starts after the day b of the previous activity (i) starts. This kind of construction occurs if before the previous activity is 100% completed then activity (j) may start after a certain part of the activity (i) is completed. The number of b may not exceed the number of times of the previous activity. Because definition b is part of the period of past activities. So here overlapping activities occur.

3. Constructions completed to completion - Finish to Finish (FF) Provides an explanation of the relationship between the completion of an activity and the completion of previous activities. Or FF (i-j) = c, which means an activity (j) is completed after the c day of the previous activity (i) is completed. This kind of construction prevents the completion of an activity reaching 100% before the previous activity has been (= c) finished. Number c may not exceed the number of time periods of the relevant activity (j).

4. Constraints start to finish - Start to Finish (SF) Describe the relationship between the completion of the activity and the start of the previous activity. Written with SF (i-j) = d, which means an activity (j) is completed after the previous day of activity (i) begins. So in this case a portion of the previous portion of the activity must be completed before the final part of the intended activity can be completed.

So in compiling the PDM network, specifically determining the order of dependencies, given the various constraints, more factors must be considered than CPM.

RESEARCH METHODS

1. Introduction Studies

The new hauling stone mine road owned by PT. Binuang Mitra Bersama crosses the national road (crossing), for compliance with the Ministry of Public Works and Public Housing as the national road responsible, PT. Binuang Mitra Bersama is required to build an Overpass Bridge with a 1 (one) year time limit or the July 2018 deadline.

2. Library Studies

In this literature study, researchers will collect theories or methods that relate to the problem being studied. The theoretical foundations used are as follows; construction management, construction delays, causes of project delays and project scheduling.

3. Data Collection

The data needed in this study are secondary data and primary data, the following is an explanation;

a. Secondary Data; secondary data from PT. Agrabudi Jalan Berdikari and pengawasa consultant CV. The Main Technician Partner is required to create network diagrams such as contract data, contract volume data, working group number data, time schedule, unit price quantity analysis estimated data, installed volume data and physical progress data.

b. Primary data; Primary data is obtained by direct interview method with General Superintendent (G.S) and Site Engineer (S.E) supervisor consultant such as discussion with Site Engineer (SE) how to solve problems and additional hours of overtime work.

4. **Physical Study** Activities carried out in physical studies are as follows:

a. Calculates physical progress, which is calculating the percentage of realization of work progress, plans and deviations.

b. Calculate the remaining volume, which is counting the remaining volume of work that has not been installed.

5. *Identification of Project Factors*

Identification of project factors consists of internal factors and external factors, these factors are as follows:

1. Internal factors, which consist of availability of materials, labor, tools and working hours.

2. External factors, which consist of weather, project land, community around projects and government policies.

6. *Impact Identification*

Impact identification is to identify each problem that arises and provide a solution that is fast, precise and the target time for problem solving so that the implementation time in the field is in accordance with the time of implementation in the contract.

7. *Preparation of the Acceleration Method.*

Activities carried out in the preparation of the crash program are as follows:

a. Determination of network analysis; that is determining the right network analysis to facilitate the completion of the work.

b. Making Precedence Diagram Method (PDM) diagrams; that is making scheduling Precedence Diagram Method (PDM) based on the initial contract, due to delays in the installation of girder for 21 (twenty one) calendar days and acceleration (rescheduling) in critical situations.

c. Analyze techniques or acceleration strategies to speed up the completion of work; which is making a strategy of acceleration with a repeat tracking analysis or perceptions in activities on critical trajectories to complete work in accordance with the two contract times, analyzing direct costs, indirect costs and profits.

RESULTS AND DISCUSSION

1. Bridge Technical Data.

The overpass bridge technical data is as follows; total bridge length 186.37 meters, total bridge length + oprit bridge 362.87 meters, bridge width 8.50 meters, sidewalk width left / right 1.00 meters, total bridge width 10.50 meters, girder length 30.00 meters, the length of oprit is 90.42 meters and the length of the oprit is 88.58 meters.

2. Data Item Works for Bridge Projects

The items of the bridge project work consist of; General Division I, Division III Land Works, Division IV Widening of Road Pavement and Shoulder, Division V Grained Pavement, Division VI Pavement, Division VII Structure and Division VIII Minor Returns and Works.

3. Physical Study

Physical progress for the 18th week up to February 25, 2018 realized 68.27%, plans 62.26% and deviations plus 6.01%. There will be a temporary stop for 21 calendar days or the next 3 (three) weeks will experience a delay with a deviation of minus 2.41%.

4. Identification of Project Factors

a. Internal factors

Internal factors have no problems, such as availability of materials, labor, tools and working hours.

b. External factors

External factors consist of weather, project land, communities around projects and government policies. At the beginning of the project there were problems with land acquisition for temporary roads in addition to the overpass bridge construction site. Problems can be solved by compensation in accordance with mutually beneficial agreements.

5. Impact identification

Impact identification is to identify each problem that arises and provide a solution that is fast, precise and the target time for problem solving so that the implementation time in the field is in accordance with the time of implementation in the contract.

a. External Problems from the Community

The ongoing project arises problems from the people who complain about the location of the retaining wall and gravity wall for the construction of bridge. The solution to this problem is to replace land in another place and build a house on the land.

b. External Problems from the Government

The ongoing project the government has temporarily suspended the installation of girder for 21 (twenty one) days, as a result of the termination it will have an impact on the progress of physical progress and minus deviations. While the impact on the duration of the contract will increase initially 240 (two hundred and forty) calendar days to be 261 (two hundred sixty one) calendar days. The solution to this problem is to crash the program by making diagran net working and rescheduling.

6. Preparation of the Acceleration Method

a. Net working diagram determination:

- Making work activities based on job design drawings.
- Making logic by simplifying each stage of work activities for the purpose of each work activity can be divided and made working group groups.
- After making parts of work activities and working group groups, the composition and number of activities and the relevance or dependence of them are seen.
- Based on the description of the three points above, for the right networking method diagram is used for the construction of the overpass haul road bridge Km. 2 is "Precedence Diagram Method (PDM)".

b. Making a Precedence Diagram Method (PDM)

Diagram Making the precedence diagram method (PDM) based on the initial contract, the temporary termination of 21 (twenty one) calendar days installation of the girder and crash program (Rescheduling) is as follows:

- Making work activities based on job design drawings.
- Activities are made into 41 (forty one) activities.
- Calculate the duration of each activity based on the estimated quantity of labor in the analysis of the unit price of the contractor.
- Making logic by simplifying each stage of work activities for the purpose of each work activity can be divided and made working group groups.

- After making parts of work activities and working group groups, the composition and number of activities and the relevance or dependence of them are seen.
- Calculating Earliest Start (ES), calculating Earliest Finish (EF), calculating Latest Start (LS), calculating Latest Finish (LF), calculating Free Float (FF), calculating Float Total (TT) and determining the critical path.

c.   Analyzing Techniques or Strategies to Speed Up Work Settlement.

The duration due to the temporary termination of the installation of girder for 21 (twenty one) calendar days becomes 261 (two hundred sixty one) calendar days so that it exceeds the duration of the initial contract 240 (two hundred forty) calendar days, by crashing the program (rescheduling) on the critical track, the duration of time is 231 (two hundred thirty one) calendar days or the duration of time is reduced by 9 (nine days) calendar days. The following is a breakdown of the cost of the Overpass bridge construction project;

- Value of contract (VAT) of Rp.49,183,221,000.00.
- The direct cost of the initial contract is Rp.3,902,130,049.20.
- The direct cost of crash programs is Rp.3,902,130,049.20.
- The indirect cost of the initial contract is Rp. 503,610,917.41
- Indirect crash program costs Rp.489,060,917.41.
- Initial contract profits of Rp.3,398,528,131.79.
- Advantages of crash programs amounting to Rp. 3,413,078.79.
- The cost efficiency of the crash program for the initial contract is Rp. 14,550,000.00.

The result of a reduced crash program is indirect costs such as reducing the salary of contractor employees because of a reduced duration of 9 (nine) days. Decreased employee salaries are salaries of Project Managers, Site Managers, Quantity and Quantity Engineers, Bridge Engineers, Site Engineers, Surveyors, Drafter and Logistics. With this reduction will have an impact on the increase in contractor profits and cost efficiency.

CONCLUSION

Based on problems with the overpass haul road bridge construction project Km. 2 belongs to PT. Binuang Mitra Bersama on the national road segment, so in this study it can be concluded that the research results are as follows:

1. Factors that cause delays in the construction of bridges overpass haul road km. 2 belongs to PT. Binuang Mitra Bersama is an external factor due to delays in the work of installing girder by the government, that is the Ministry of Public Works and Public Housing, physical progress is as follows;
a. Up to the 18th week or up to February 25, 2018 is the plan of 62.26%, realization of 68.27%; 6.01% deviation.
b. As a result of the accusation of work for 21 calendar days or the next 3 (three) weeks will cause a delay of minus 2.41%.
2. The handling approach is carried out by accelerating (rescheduling) the network (networking), that is changing the dependence of early start on critical track activities, the duration of time being 231 calendar days and cost efficiency of Rp. 14,550. 000.00.

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