

Analysis Of Project Acceleration Using The Crasing Method With Additional Hours Of Work Optimum Overtime

¹Rinaldy, ²Zulyaden, ³Edi Mawardi

^{1,2,3}Department Civil Engineering, Universitas Teuku Umar, Meulaboh 23617, Indonesia.

Corresponding Author:Rinaldy

Abstract:*In the implementation of a project, many factors can affect the continuity of work, thus affecting the success of the project. One of the factors that affect the success of the project is the delay in project completion or the inaccuracy of project completion time, as a result of which a project will experience a change in duration or delay. To be able to overcome the problem of delays in a project, it is necessary to control the implementation of each work item. With good control, this business can ensure that the work will be carried out in accordance with the provisions. So as to minimize losses caused by delays in implementation. One solution that can solve this problem is to speed up the execution duration. This study aims to obtain the optimum duration with efficient or minimum costs in completing a project and to find out the time and costs that can be realized in the construction project of the type-2 dormitory building of MAN 1 Aceh Barat. This research uses a quantitative approach with direct data sources in the field. The data analysis was carried out with the help of the Microsoft Project 2013 program and the final method used was the Crashing method . By applying the Crashing calculation method, it can be concluded that with the addition of 1 hour of working time, the increased cost is Rp. 31.210.346,49 with a difference of 3 days of savings. For 2 hours of working time, there is an additional fee of Rp. 37.153.968,05 , with a difference of 12 days of savings. with the addition of 3 hours of overtime work accelerated the project duration by 135 days from 150 days of planning, which means it has a difference of 15 days of time savings from the initial plan. The total cost of additional overtime costs is Rp. 35.607.602,63, with a working time savings of 15 days, the total construction cost was Rp. 2.698.356.000 of the originally planned amount. Rp. 2.723.400.000.*

Keywords:*Acceleration, Project, Duration, Crashing, MS.Project.*

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I. INTRODUCTION

advanced world civilization accompanies the increase in construction development which is getting better and more closely related to the needs of human life. In its realization, construction projects must be able to meet the success criteria in terms of quality, cost and time [1]. But in reality, it is not impossible that a project will experience delays. Many factors can affect delays including weather conditions related to the continuity of work, availability of labor and productivity, fulfillment of material and mobilization schedules, and other things that can hinder the course of a job [2].

To be able to overcome the problem of delays in a project, it is necessary to control the implementation of each work item. With good control, this business can ensure that the work will be carried out in accordance with the provisions. So as to minimize losses caused by delays in implementation [3]. One way that can be used as a solution is to optimize work time, but this can lead to additional costs that must still be carefully estimated.

Additional working time or in other words called overtime work is working time that is longer than normal working hours. In the sense of work that is usually carried out from 08:00 to 17:00, during overtime hours workers will continue to work even though they have passed their usual working time limit. This additional working time will be adjusted to the daily work calculation determined by the head of the craftsman. This overtime hour also includes a calculation of the cost of wages outside the normal daily wage. Besides, there must be fulfillment of facilities in order to support the work done in overtime hours [4] . To get the calculation of the optimum work duration with the minimum possible cost, it is necessary to have a schedule to be able to show work activities that are on a critical path and know the productivity of their workforce.

The review in this research is found in the construction project of the Type-2 Female Dormitory of MAN 1 Aceh Barat. Efforts to accelerate this project are intended so that the project can be completed on time according to the completion deadline stated in the contract and then it can be immediately operationalized during the admission of new students for the coming academic year. Seeing some work items that were delayed

due to the lack of number and productivity of the workforce so that there was a deviation in the target for achieving weekly work weight progress, the authors were interested in studying the solution by adding optimum overtime hours using the crashing method.

This method will also calculate the amount of costs incurred for exchange with the duration of time in order to reach the completion deadline or even if possible it can be completed with a smaller duration than the initial plan. This study aims to obtain the optimum duration with efficient or minimum costs in completing a project and to find out the time and costs that can be realized in the type-2 dormitory building project MAN 1 Aceh Barat.

II. EXPERIMENTAL PROCEDURE

2.1. Crasing Method

Crashing method is a method that is used intentionally to be able to estimate a number of expenses that will be exchanged for the duration of work. The steps in the Crashing calculation are as follows:

1. Calculating *Crashing production*

$$\text{Prod. Crash} = \text{Prod. Normal} + \text{Prod. overtime}$$

Overtime productivity is calculated based on the effectiveness of the workers for every 1 hour, 2 hours, and 3 hours of overtime

2. Calculate the duration of the work after the acceleration

$$\text{Crash Duration} = \text{Volume} / \text{Prod. Crash}$$

Crashing productivity is productivity after overtime so that the productivity value increases from normal productivity

3. Calculating *Crashing costs*

To be able to calculate the costs that will be incurred during the acceleration period, it is necessary to calculate the cost of overtime wages and the costs of supporting activities such as facilities and equipment. The cost of lighting is the total expenditure to facilitate the work. Not only the cost of buying equipment, the cost of electricity usage is also included in it. So this fee will be adjusted to the length of time the electricity is used. The cost of overtime wages which is an additional cost in addition to the normal wage cost can be calculated using the formula:

$$\text{Additional wages fee} = \text{Total. Overtime pay} \times \text{Crashing Duration}$$

Crash duration or acceleration duration is the duration of completion of work after overtime. *Crash* duration is calculated using the formula in equation 2.

Table 1 . Critical Path Work Items Performed Acceleration

No	Work item	Normal duration (days)
1	Excavation of tread foundations and wells	8
2	Ordinary digging	7
3	Empty stone pair	5
4	Stone couple	10
5	Sloof castings	6
6	Sloof thread reinforcement	7
7	Sloof plain reinforcing iron	7
8	Sloof Formwork	9
9	Floor beam thread	7
10	Plain iron floor beams	7
11	Floor beam formwork	6

12	2nd floor brick wall	19
13	Plastering2nd floor	14
14	2nd floor ceiling work	8
15	2nd floor wall painting	8

2.2. Microsoft Project

After accelerating with the method of adding overtime hours, with the help of *Microsoft Project* , the total duration of the day was obtained which was smaller than the initial plan.

III. RESULTS AND DISCUSSIONS

The results obtained after overtime for 1 hour, 2 hours and 3 hours there was a change in the duration of project completion and the costs increased and decreased. After accelerating with the method of adding overtime hours, with the help of *Microsoft Project* , the total duration of the day was obtained which was smaller than the initial plan. Changes in the duration of each work item can be seen in the following table:

Table 2 . Comparison of Work Duration

No	Work item	Normal	1o'clock	2O'clock	3o'clock
1	Excavationtread and pit foundation	8	8	7	7
2	ExcavationNormal	7	7	6	6
3	Empty stone pair	5	5	5	4
4	River stone pair	10	9	9	8
5	Sloof castings	6	6	5	5
6	Sloof thread reinforcement	7	7	6	6
7	Plain reinforcing steel sloof	7	7	6	6
8	Sloof formwork	9	9	8	7
9	Floor beam thread	7	7	6	6
10	Plain iron floor beams	7	7	6	6
11	Floor beam formwork	6	6	5	5
12	2nd floor brick wall	19	18	16	15
13	Plastering2nd floor	14	13	12	11
14	2nd floor ceiling work	8	8	7	7
15	2nd floor wall painting	8	8	7	7

Based on scheduling using *Microsoft Project software* , the total duration of work is obtained as follows:

- 1 overtime hours = 147 days
- 2 overtime hours = 138 days
- 3 overtime hours = 135 days

Figure 1 . Comparison of Normal and Overtime Duration

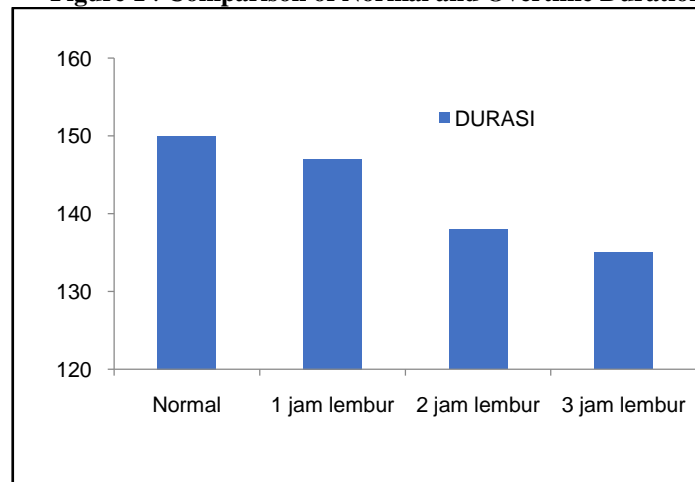


Table 3 . Indirect Cost Recapitulation

Indirect Cost/day		Rp. 1.650.604
1 hour	3 days	Rp. 4.951.812
2 hours	12 days	Rp. 19.807.247
3 hours	15 days	Rp. 24.759.059

Table 4 . Recapitulation of Lighting Fees and Wages

Cost Description	1 hour overtime	2 hours overtime	Overtime 3 hours
Lamp cost	Rp. 916.500	Rp. 916.500	Rp. 916.500
Cable fee	Rp. 373.000	Rp. 373.000	Rp. 373.000
Plug fee	Rp. 30.000	Rp. 30.000	Rp. 30.000
Stop contact fee	Rp. 72.190	Rp. 72.190	Rp. 72.190
Installation fee	Rp 280.000	Rp 280.000	Rp 280.000
Electricity cost	Rp. 4.013,06	Rp 32.104,51	Rp. 60.195,96
Total lighting cost	Rp. 1.675.703,06	Rp. 1.703.794,51	Rp. 1.731.885,96
Total Wage Cost	Rp. 29.534.643,43	Rp. 35.450.173,34	Rp. 33.875.716,67
Total Cost	Rp. 31.210.346,49	Rp. 37.153.968,05	Rp. 35.607.602,63

Table 5 . Recapitulation of Added and Subtracted Costs

Time	Additional fee	Less cost
Normal	Rp -	Rp -
1 hour	Rp31.210.346	Rp 11.846.392

2 hours	Rp 37.153,968	Rp 46.913.962
3 hours	Rp 35.607.603	Rp 60.747.164

Figure 2 . Recapitulation of Added and Subtracted Costs

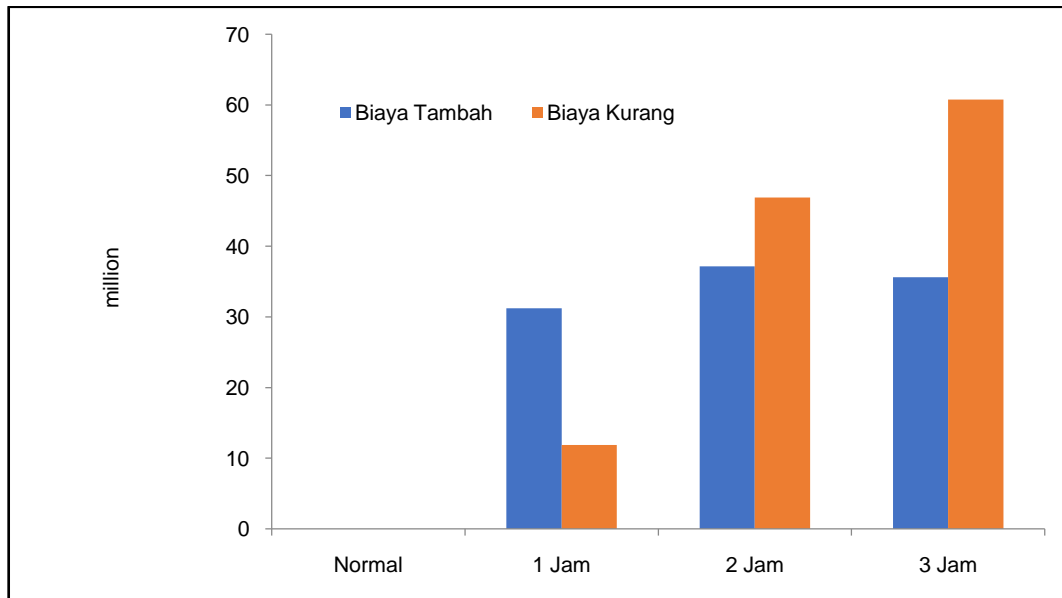
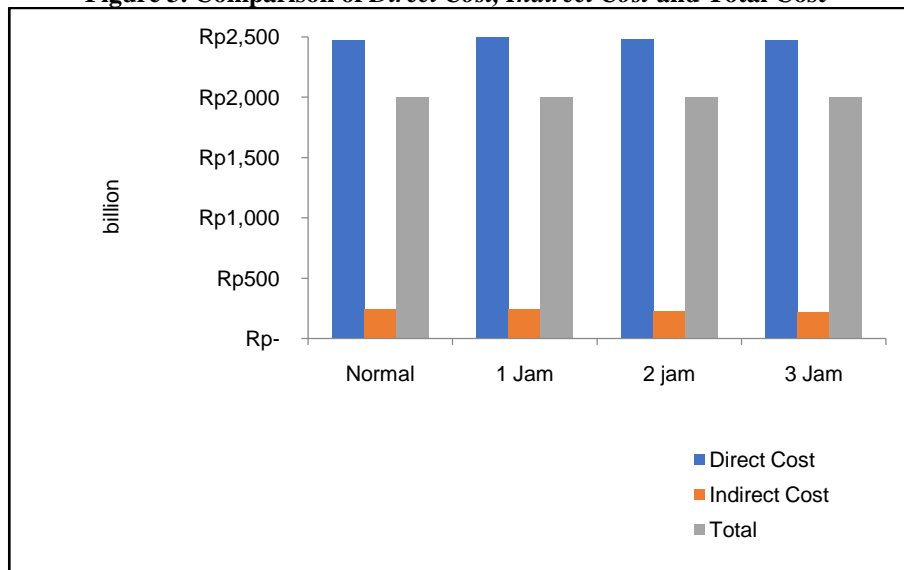


Table 6. Time and Cost Recapitulation

Crash	Duration (Days)	Direct cost (Billion)	No fee Direct (Million)	Total (Billion)
N	150	Rp. 2.475	Rp. 247,5	Rp. 2.723
1 J	147	Rp. 2.500	Rp. 242,6	Rp. 2.742
2 J	138	Rp. 2.485	Rp. 227,7	Rp. 2.713
3 J	135	Rp. 2.475	Rp. 222,8	Rp. 2.698

Figure 3. Comparison of Direct Cost, Indirect Cost and Total Cost



III. CONCLUSION

1. From the results of calculations by accelerating, for 1 hour of overtime the duration is 147 days, which means it has a difference of 3 days from the initial planning, for 2 hours of overtime the duration is 138 days so that it has a difference of 12 days from the initial planning, and for the calculation of 3 hours of overtime then the acquisition duration is 135 days and has a 15-day difference from the initial plan.
2. With the addition of 1 hour of working time, the additional cost is Rp. 31.210.346,49 For 2 hours of working time there is an additional fee of Rp. 37.153.968,05, and for the addition of 3 hours of working time, the cost to be incurred is Rp. 35.607.602,63.
3. Overtime working hours of 3 hours is the most optimum alternative, in addition to the difference in work completion time which is reduced by 15 days, the total project cost is also lower, namely Rp. 2.698.356.000 which was originally worth Rp. 2.723.496.000.

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