PROJECT PLANNING AND CONTROLLING IN SAMARINDA-BALIKPAPAN TOLL ROAD PROJECTS

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PROJECT PLANNING AND CONTROLLING IN SAMARINDA-BALIKPAPAN TOLL ROAD PROJECTS

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Abstract

Samarinda to Balikpapan Toll Road Project is the important project because it can help people on Samarinda or Balikpapan so there is need controlling on cost and time therefore it needs more attention to do the planning and controlling for the simple flats project with an assistance from Microsoft Project to do the planning, scheduling, and controlling to prevent a delay on duration and project deviation by using crashing method. Deviation that happens on Toll Roads project will be classified based on the impact of the deviation.

Index Terms-- Controlling, Crashing, Microsoft Project, Planning, Scheduling, Toll Road Project

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INTRODUCTION

Along with the rapid population growth the need for infrastructure has also greatly increased, because more and more residents the need for displacement has also greatly increased, the displacement undertaken requires good infrastructure, especially in the Samarinda - Balikpapan toll road project because residents who live in Samarinda if you want to travel out of the city using air transportation must make a flight at the Sepinggan airport in Balikpapan, the journey must be by land and the trip from Samarinda to Balikpapan takes up to 2.5 to 3 hours.

This toll road will reduce travel time to 1.5 to 2 hours. Moreover, it will really help the people who live in Samarinda because it will save money and time in traveling to the Sepinggan airport in Balikpapan. In a construction work, especially on the Samarinda -Balikpapan toll road project scheduling is very important, because with the scheduling of the achievement of work time will be more maximal, then scheduling is needed to calculate the duration and volume of work, in scheduling there is a period of project activities, resources material and labor, with a good scheduling it will produce timeliness and cost efficiency in construction projects.

RESEARCH METHOD

Figure 1. Research Flow Chart

Data analysis was carried out to achieve the objectives and results of the study. In the implementation process, data analysis techniques are divided into stages of the research process, namely:

a. Planning a project schedule using Microsoft Project 2016, which consists of:

- Create a Work Breakdown Structure (WBS) in Task name

WBS is done by breaking down project sub-work into more detailed and organized work items. Task name settings can be done using the indicator "indent" or "outdent" in compiling each project work.

- Creating links or connecting between jobs

This stage is done by linking one job to another with the "link the selected task" indicator. The work to be connected must be interrelated or dependent. Sooner or later the first job will affect the next job.

- Insert a resource sheet

Filling in the resource sheet is done by entering a list of resources such as the number of labor, materials, and tools that have been made in the RAB (Budget Plan) which also includes the unit, volume, and unit price analysis for each job. The list of resources is then entered in the resource sheet table in Microsoft project 2016

- Make a basic analysis of resource requirements using Microsoft Excel

Making a basic analysis is needed in calculations to find the coefficients that will be used for each resource. In these calculations, the required volume of work and the unit coefficient for each resource is based on a predetermined SNI. Number of Resources = SNI Coefficient x Work Volume

- Fill in the resource information for each job

This stage is done by entering the coefficients that have been calculated based on the basic analysis of each work unit. Where filling these coefficients will calculate the total cost of the work to be done.

- Determine the duration of each job

Determination of the duration of the work carried out based on the project implementation method used. In this study the duration of each work item is determined.

- Make an S curve plan

The S curve of the plan is made to determine the project implementation time based on the planning that has been formed starting from the beginning to the end of the project in Microsoft Project 2016 which will be displayed in Microsoft Excel. The S curve of the plan shows the percentage of progress that will be run every week.

b. Monitoring the implementation of activities project

- Input the start and end dates for an activity;
- Noting the progress of each activity as a percentage;
- Checking resources, whether there is a lack or exceeds the plan;
- Anticipating project problems

c. Evaluating each project activity

- Input the progress of each work in Microsoft Project 2016;
- Make an actual S curve;
- Compares the plan S curve with the actual S curve;
- Identify deviations in the project;
- Determine completion steps if project deviations occur
- Make corrections and improvements if needed.

RESULT AND DISCUSSION

Based on observations obtained the method of carrying out earthworks that will be used on the Samarinda-Balikpapan toll road project are as follows:

a. Mobilization
b. Workplace cleaning / clearing
c. Common land for pile
d. Ordinary land scrap for disposal / waste
e. Sub soil preparation / sub grate

With the project completion plan for 314 working days starting on June 1, 2017 until April 28, 2018

A. The Calculation of Production Capacity of Each Tool

Table I. Production capacity of each tool

No.	Type of Heavy Equipment	Production capacity of equiptnment per hour (m^3)
1	Excavator	24,15
2	Dump Truck	12,61
3	Motor Grader	89,14
4	Vibrator roller	93,47
5	Water Tank Truck	71,14

Based on Table I, the production capacity of each tool can assist in calculating the need for tools needed in each work item where the number of tools needed will be adjusted to the volume of each work item. The number of actual tools in the field is presented in Table II.

Table II. The Number of Actual Tools

No	Job	The Number of Actual Equipment at the Field				
		Excavator	Dump Truck	Motor Grader	Vibrator Roller	Water Tank Truck
1	The diggings of soil for piles	3	6	1	1	1
2	The diggings of soil for dispose	4	8	-	-	-

Based on Table II, the number of tools in the field is the number of heavy equipment used on each work item. The number of the equipment will be calculated by the volume of work for each work item. The volume of each work item is presented in Table III.

Table III. Volume of Each Work Item

No	Job Type	Work Volume (m^3)
1	The diggings of soil for piles	216493
2	The diggings of soil for dispose	516987

Based on the calculation of the volume of each work item to get the equipment that should be used for the work item is appropriate or not by calculating the production capacity per day with the following equation;

Daily Tool Production Capacity = hourly production capacity x effective working hours

The results of production capacity per day are presented in Table IV.

Table IV. The Production Capacity of Tool per Day

No.	Type of Heavy Equipment	The Production Capacity of Equipment Per Day (m^3)
1	*Excavator*	386,4
2	*Dump Truck*	201,76
3	*Motor Grader*	1426,24
4	*Vibrator roller*	1495,52
5	*Water Tank Truck*	1138,24

After getting the production capacity of heavy equipment per day can do the calculation of the duration of the tool with the following equation;

$$\text{The Duration of 1 equipment} = \frac{\text{Work Volume}}{\text{The capacity of equipment per day}}$$

The duration of one tool for each heavy equipment is presented in Table V.

Table V. The Duration of One Equipment

No.	Type of Heavy Equipment	The Duration of One Equipment
1	*Excavator*	560,28
2	*Dump Truck*	1073,02
3	*Motor Grader*	151,79
4	*Vibrator roller*	144,76
5	*Water Tank Truck*	190,20

The duration of one equipment is a number that will be entered into the unit in assigning resources to the Microsoft project with the condition that the machine is made into material on the resource sheet so that it will get the needed heavy equipment based on the volume of work.

The need for tools that are used based on the volume of work done based on the duration of each work item where for the pile of work is planned for 140 working days and ordinary excavation to be planned for 300 working days, the results of the need for tools following the volume of work using Microsoft Project 2016 can see in the resource graph presented in Fig. 2 to Fig. 5.

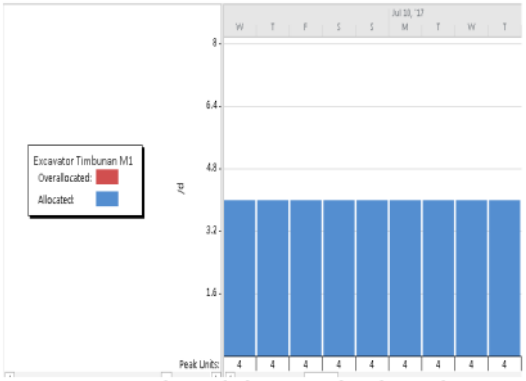


Figure 2. The Need of Excavator for Piles Work

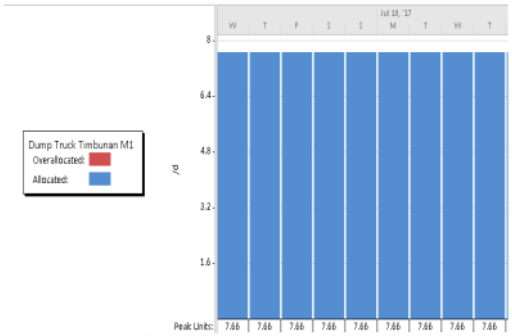


Figure 3. The Needs of Dump Truck for Piles Work

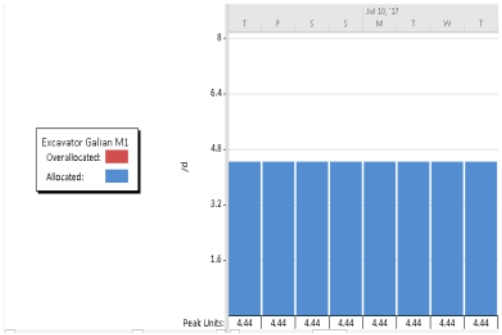


Figure 4. The Needs of Excavator for Digging

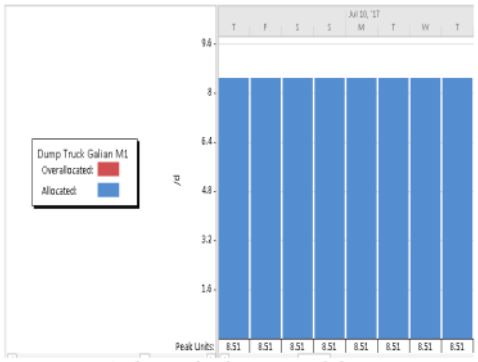


Figure 5. The Needs of Dump Truck for Diggings

Based on Fig. 2 to Fig. 5, the needs of equipment according to the volume of work presented in Table VI

Table VI. The Needs of Equipment based on Work Volume

No	Job	*Excavator*	*Dump Truck*	*Motor Grader*	*Vibrator Roller*	*Water Tank Truck*
1	The diggings of soil for piles	4	8	1	1	1
2	The diggings of soil for dispose	5	9	-	-	-

Whereas the number of actual equipment in the field is presented in Table VII

Table VII. The Needs of Equipment According to the Work Volume

No	Job Description	*Excavator*	*Dump Truck*	*Motor Grader*	*Vibrator Roller*	*Water Tank Truck*
1	The diggings of soil for piles	3	6	1	1	1
2	The diggings of soil for dispose	4	8	-	-	-

Based on the results above, the condition of the number of tools available in the field for work is as follows:

- The diggings of soil for the pile has a shortage of 6 units of Dump Truck in the field (out of a total of 8) while the number of other tools is in accordance with calculations and needs in the field
- The diggings of soil for disposal lacks all equipment where the excavator has a shortage of 1 unit (out of a total of 5 needed) and the Dump Truck has a shortage of 1 unit (out of a total of 9 needed).
- The diggings of soil for the pile there is a shortage of tools and only meets 75% of the number of Excavators and Dump Trucks, while for other tools as needed
- The diggings of soil for disposal there is a shortage of ATA and only meets 67% for the number of Excavators and 62% for the number of Dump Trucks

Based on the evaluation results above, the productivity results in the field are smaller than the productivity of the calculation plan, causing delays. And the plan s and actual curves are presented in Fig. 6 and Fig. 7 based on the actual progress as of December 31, 2017.

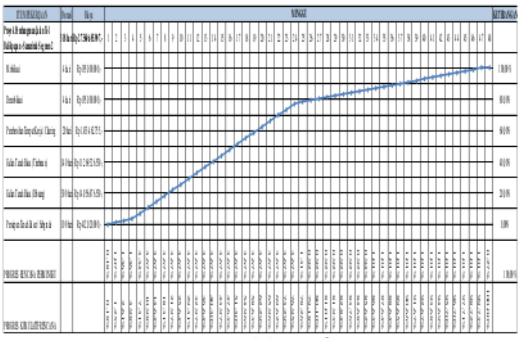


Figure 6. S Curve Plan

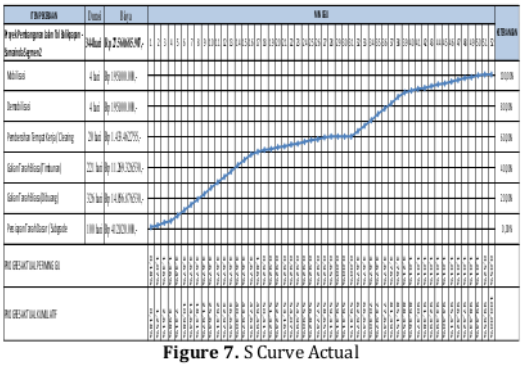


Figure 7. S Curve Actual

With the remaining 121 days, the acceleration of the addition of existing tools in ordinary diggings to be removed was conducted. It used Microsoft Project 2016 which can be seen in the resource graph presented in Fig. 8 and Fig. 9.

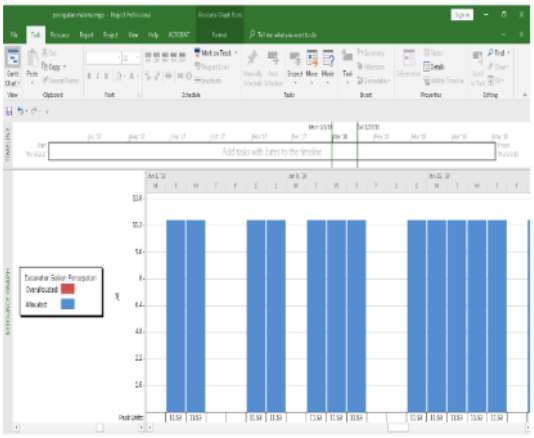


Figure 8. The Needs of Excavator for Acceleration

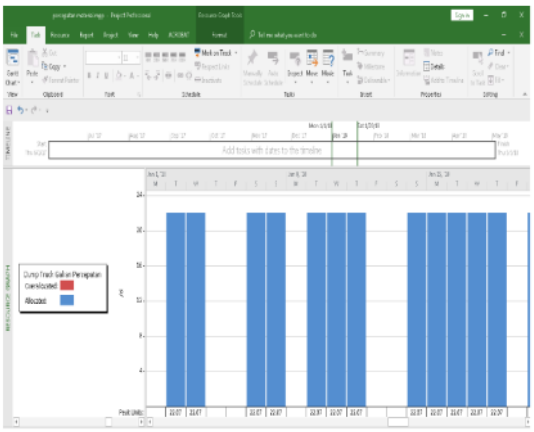


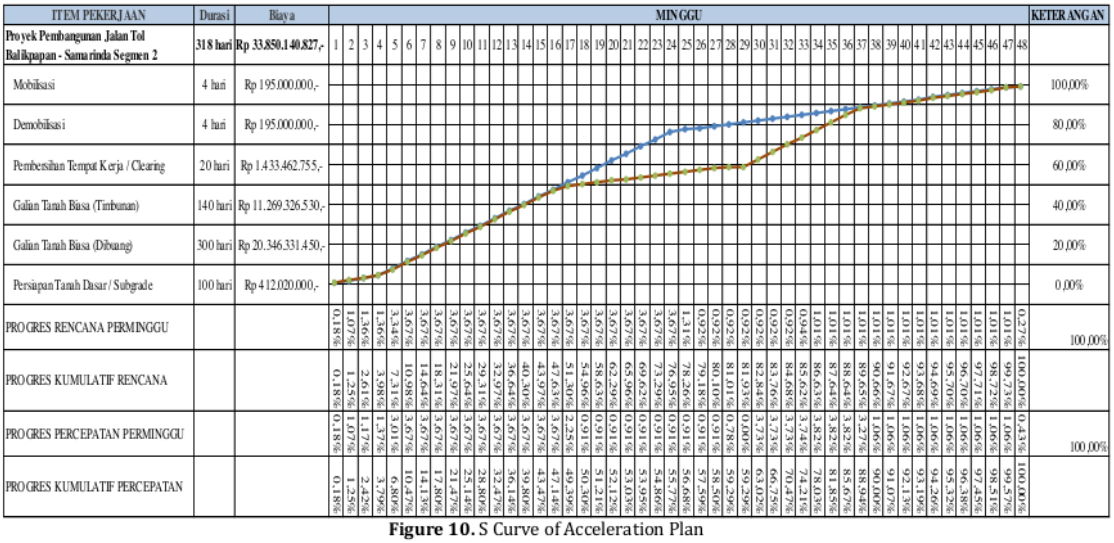
Figure 9. The Needs of Dump Track for the Acceleration

From the number of equipment for the acceleration with the help of Microsoft Project 2016 above, it can be concluded that the addition of heavy equipment is presented in Table VIII.

Table VIII. Number of Acceleration Tools

No	Job Description	*Excavator*	*Dump Truck*
1	The diggings of soil to dispose before the acceleration	4	8
2	The diggings of soil to dispose after the acceleration	12	22
3	The increase of the need of heavy equipment	300%	275%

From Table VIII, an increase in the number of excavator is by 300% and an increase in the number of dump trucks is by 275% and the S curve of the Acceleration Plan is presented in Fig. 10.



ITEM PEKERJAAN	Durasi	Biaya	MINGGU	KETERANGAN
Proyek Pembangunan Jalan Tol Balikpapan - Samarinda Segmen 2	318 hari	Rp 33.850.140.827,-	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	
Mobilisasi	4 hari	Rp 195.000.000,-		100,00%
Demobilisasi	4 hari	Rp 195.000.000,-		80,00%
Pembersihan Tempat Kerja / Clearing	20 hari	Rp 1.433.462.755,-		60,00%
Galian Tanah Biasa (Timbunan)	140 hari	Rp 11.269.326.530,-		40,00%
Galian Tanah Biasa (Dibuang)	300 hari	Rp 20.346.331.450,-		20,00%
Persiapan Tanah Dasar / Subgrade	100 hari	Rp 412.020.000,-		0,00%
PROGRES RENCANA PERMINGGU			0,18% 1,07% 1,36% 1,36% 3,34% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 1,31% 0,92% 0,92% 0,92% 0,92% 0,92% 0,92% 0,94% 1,01% 1,01% 1,01% 1,01% 1,01% 1,01% 1,01% 1,01% 1,01% 1,01% 1,01% 1,01% 1,01% 0,27%	100,00%
PROGRES KUMULATIF RENCANA			0,18% 1,25% 2,61% 3,98% 7,31% 10,98% 14,64% 18,31% 21,97% 25,64% 29,31% 32,97% 36,64% 40,30% 43,97% 47,63% 51,30% 54,96% 58,63% 62,29% 65,96% 69,62% 73,29% 76,95% 78,26% 79,18% 80,10% 81,01% 81,93% 82,84% 83,76% 84,68% 85,62% 86,63% 87,64% 88,64% 89,65% 90,66% 91,67% 92,67% 93,68% 94,69% 95,70% 96,70% 97,71% 98,72% 99,73% 100,00%	
PROGRES PERCEPATAN PERMINGGU			0,18% 1,07% 1,17% 1,37% 3,01% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 2,25% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 3,67% 0,91% 0,91% 0,91% 0,91% 0,91% 0,91% 0,91% 0,91% 0,91% 0,78% 0,00% 3,73% 3,73% 3,73% 3,74% 3,82% 3,82% 3,82% 3,27% 1,06% 1,06% 1,06% 1,06% 1,06% 1,06% 1,06% 1,06% 0,43%	100,00%
PROGRES KUMULATIF PERCEPATAN			0,18% 1,25% 2,42% 3,79% 6,80% 10,47% 14,13% 17,80% 21,47% 25,14% 28,80% 32,47% 36,14% 39,80% 43,47% 47,14% 49,39% 50,30% 51,21% 52,12% 53,03% 53,95% 54,86% 55,77% 56,68% 57,59% 58,50% 59,29% 59,29% 63,02% 66,75% 70,47% 74,21% 78,03% 81,85% 85,67% 88,94% 90,00% 91,07% 92,13% 93,19% 94,26% 95,32% 96,38% 97,45% 98,51% 99,57% 100,00%	

Figure 10. S Curve of Acceleration Plan

CONCLUSION

Based on the results of planning and control of the Samarinda-Balikpapan Toll Road Project using the assistance of the Microsoft Project 2016 program, the following conclusions are obtained:

a. Based on the initial planning of the project, the total duration of the project was 318 working days, starting on June 1, 2017 until April 28, 2018 with a maximum workforce of 35 people needed 9 Excavators and 17 Dump Trucks

b. Based on the results of progress in the field inputted using the Microsoft Project 2016 program up to December 31, 2017, it obtained a progress plan of 81.01% and an actual progress of 59.31%. Experienced a deviation of 21.70%.

c. The results of planning and controlling using Microsoft Project 2016 the duration of the project implementation plan is 318 days and based on actual input in the implementation field the estimated duration of project completion is 344 days, where the project has been delayed for 26 days from the duration of the plan.

d. Evaluation of the actual number of tools used in the field is in ordinary earthworks for embankment where there is a shortage of tools and only meets 75% of the number of Excavators and Dump Trucks, while for other tools as needed. In ordinary earthworks for disposal there is a shortage of tools and only meets 80% of the Excavators and 89% of the Dump Trucks

e. The causes of the delay experienced during the Samarinda-Balikpapan toll road project include:

- There are weather constraints
- Labor is reduced because cash flow is not good from the project
- The number of tools is not according to plan
- The actual tool production capacity does not match the theoretical tool production capacity

f. Based on the calculation of the accelerated planning carried out, with the acceleration duration of 26 days (from the total duration of the project before acceleration of 344 days) to the total duration of the project after acceleration of 318 working days by using an alternative means of adding heavy equipment with details.

- The number of actual Excavators in the field is 4 units to 12 units or an increase of 300%

Actual dump trucks in the field of 8 units to 22 units or an increase of 275%

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