

Planning & Controlling Tourism Landscape Design Project using Critical Chain Project Management (CCPM) Scheduling

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Abstract—Project Management must meet the performance criteria of timeliness and budget control agreed between the project owner, contractor and supervisor. However, the level of uncertainty in the project implementation process is very high and causes delays and over budgeting. The Village Nongkojajar is a Proposed Integrated Agropark Project as a result of the revitalization of the non-productive land of the Horticultural Seed Farm owned by the Government of East Java Province. The Landscape Architecture Project has a Creative Value Chain which is divided into Creation - Implementation - Management. Therefore scheduling and controlling the project becomes important in order to estimate working time and the project remains in accordance with the predetermined project timeline and whenever corrective action is needed. The relevance of Project Management in this research is that with high project problems, require a good planning process. The Project can be completed quickly than the specified time and more cost effective. Critical Chain Project Management (CCPM) is one method for completing and preparing projects that focus on the resource requirements for implementing projects by adding project buffers, feeding buffers and resource buffers. By analyzing using CCPM, researchers can look for optimization and control in implementing project scheduling.

Keywords—Buffer Management, Critical Chain, Critical Chain Project Management, Scheduling.

I. INTRODUCTION

CRITICAL Chain Project Management is the newest method of Lean Project Management to deal with uncertainty and risks to project completion, this method can shorten the work time without adding resources. By using the CCPM (Critical Chain Project Management) method, the company gets a critical chain that exists from each project that has a resource problem or that can cause bottlenecks (Student Syndrome, Parkinson's Law, Multitasking, and Murphy's Law) if not handled professionally.

The Village Nongkojajar, is a Proposed Integrated Agropark Project as a result of the revitalization of the non-productive land of the Horticultural Seed Farm owned by the Government of East Java Province. The development of this project is in line with the potential for the development of tourism acceleration around the Bromo Tengger Semeru National Park. The relevance of the Critical Chain Project Management to the case study of this landscape design project is to prepare the contracting company to be able to deal with uncertainties and to estimate the time quickly without adding resources. So companies can save a lot of cost

and time. This study aims to find a critical chain and calculate buffers for each job so as to produce optimal scheduling and when improvements can be made to the project work.

II. METHOD

This research uses the most recent project scheduling approach method, Critical Chain Project Management (CCPM). The following are the research steps to improve scheduling by the CCPM method: 1) This study will conduct a critical chain analysis of the Work Breakdown Structure (WBS), to separate critical and non-critical chains; 2) Reducing the time duration of each job by 50% probability of the initial duration; 3) Conduct resource leveling in order to know the resource chain used in each job, so as to minimize the occurrence of multitasking resources and accumulated work; 4) After the critical and non-critical chains are known, it can be seen that the work is added to the feeding buffer and the project buffer.

To the critical chain a project buffer is added after the last work. While feeding buffer is added to each non critical work. Buffer calculation in this study uses the Root Square Error Method (RSEM); 5) Adding feeding buffer & project buffer to the new scheduling; 6) Analysis of calculation of cost and time savings. After knowing the calculations, cost savings and time from this case study. Researchers can draw conclusions and suggestions for further research.

III. RESULT AND DISCUSSION

As a rescheduling instrument, CCPM requires an analysis of the relationship between work to one another, so that it can be identified and minimize symptoms or indications of schedule irregularities, including Student's Syndrome, Parkinson's Law, Multitasking, and other unique symptoms of deviation. In theory, the CCPM uses a 50% reduction in the probability of execution time for work to be completed. However, in reality there are some jobs in the field that cannot be reduced by 50% because there will be a reduction in the quality of work performed. The following is a list of some jobs that are not reduced by 50%, including can be seen in Table 1.

A. Determination of the Critical Chain of WBS and the relationship between jobs.

In determining the critical chain in this project, the researchers used the help of Microsoft Project 2016. So that

Table 1.
 Not reduced tasks

Tasks	Durations
Concrete Roof Installation	> 14 days
Concrete Floor Plate Installation	4-8 days
Ceramic Flooring Instalation	>4 days
Wall Finishing	2-4 days
Concrete Finishing Instalation	4-8 days

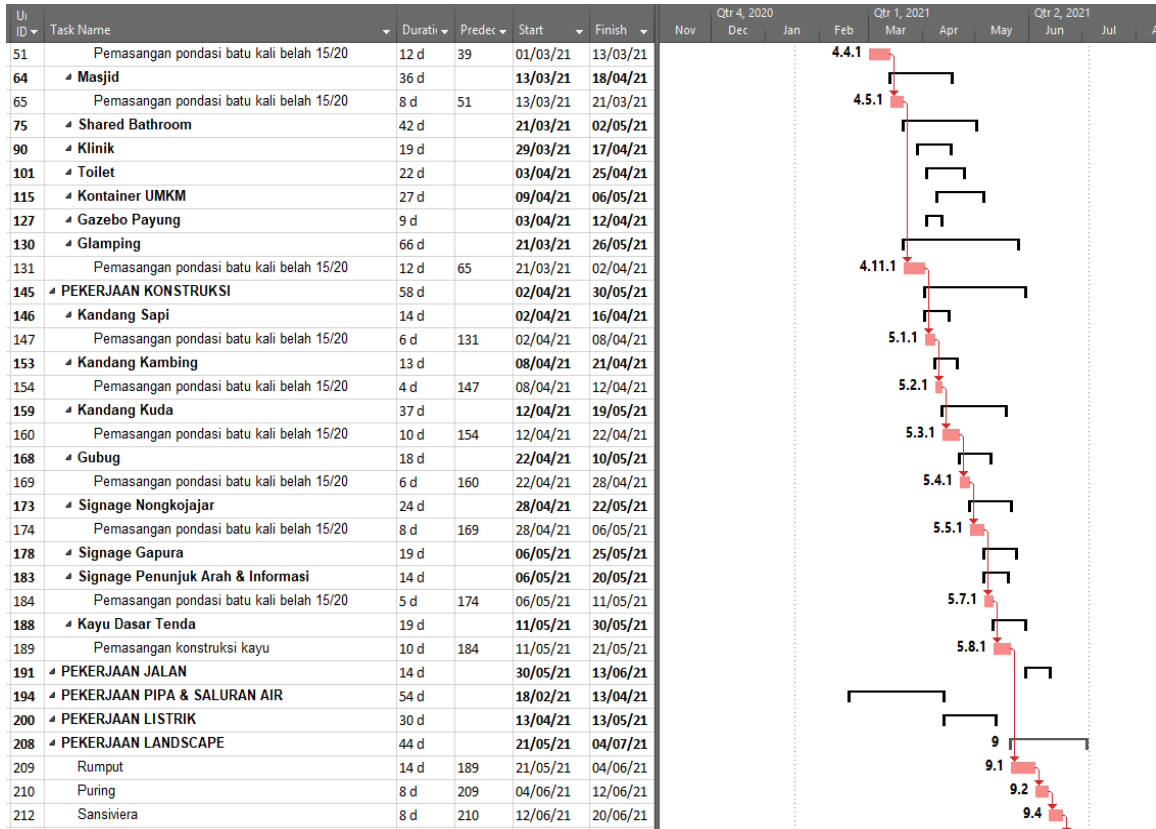


Figure 1. Critical Chain formed.

it can be seen how the critical and non-critical chains were formed can be seen in Figure 1.

B. Reduction in time duration with a 50% probability for each job

Reduction in the duration of time is done with the exception of special jobs listed in table 1. In the new scheduling using a 50% probability, it can be seen that the entire project time can be shortened from 168 working days to 81 working days can be seen in Figure 2.

C. Resouce Levelling

After the results of 3.2 processed, next step is by paying attention to the resources / resources that exist in each job so that there is no multitasking between work relationships. There are several ways to prevent multitasking, including dividing resources into groups, it can be 2 or 3 groups or adding another group that has general work in this project called Operator Helper can be seen in Figure 3.

Researchers overcome resource conflicts that occurred before by the following actions: 1) Forming 3 Stone Operator Groups; 2) Forming 4 Timber Operators Groups; 3) Forming 3 Electric Operator Groups; 4) Forming 3 Helper Operator Groups; 5) Forming 3 Cat Operator Groups; 6) Forming 3

Concrete & Welder Operators Groups. With these actions, the project went back from 81 days to 99 days.

D. Calculating feeding buffer & project buffer

Feeding Buffer is a time buffer for non-critical chains. Researchers calculate the need for Feeding Buffer for each non critical work. Project & feeding buffer is obtained by the following formula:

$$Buffer = 2 \times \sqrt{\left(\frac{w_1 - a_1}{2}\right)^2 + \left(\frac{w_2 - a_2}{2}\right)^2 + \dots + \left(\frac{w_n - a_n}{2}\right)^2}$$

where w is worst-case duration before UCPM and a average duration / optimistic duration after subtraction. A scores were obtained from interviews with experts.

After counting the Feeding Buffer & Project Buffer, each buffer is placed on the overall scheduling that has been processed. Following is the accumulation of Project & Feeding Buffer that will be scheduled in the next step can be seen in Table 2 – 3.

E. Adding feeding buffer & project buffer

Based on the overall rescheduling with the complete CCPM method approach with the addition of Project Buffer & Feeding Buffer, it can be seen that the total work time is

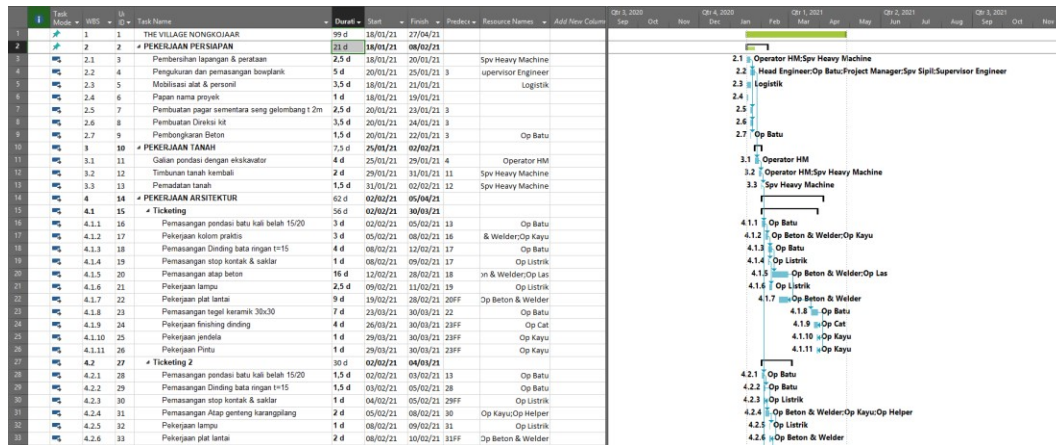


Figure 3. Critical Chain 50% Probability Reduction with Resouce Levelling

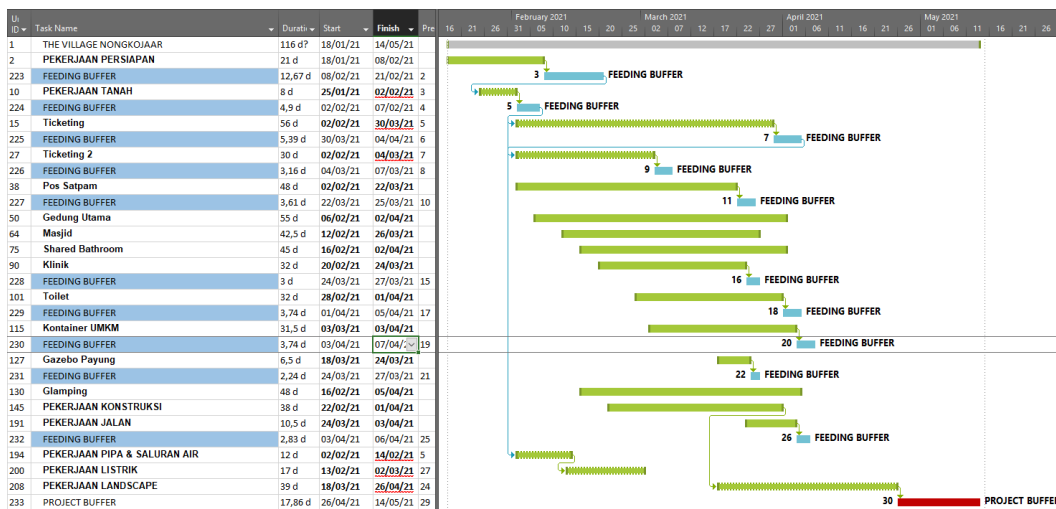


Figure 4. Critical Chain 50% Probability Reduction with Resource Levelling and Buffers.

Table 2. Feeding Buffers

FEEDING BUFFER	
PREPARATORY WORKS	7,48
LAND WORKS	4,90
TICKETING 1	5,39
TICKETING 2	3,16
SECURITY OFFICE	3,61
CLINIC	3,00
TOILETS	3,74
MSME CONTAINERS	3,74
GAZEBO	2,24
ROADWOKS	2,83

Table 3. Project Buffer

PROJECT BUFFER	
OVERALL	17,86

116 working days and can save as much as 52 working days can be seen in Figure 4.

F. Calculating Cost Savings

Shorter duration of time than the initial planning on the Master Schedule gives a good effect on corporate finance. Companies can save costs and projects more quickly completed, the velocity of money within the company becomes healthier and the money in the company can be used

as capital for other projects. Therefore it can be calculated the cost savings from the application of this CCPM method. The total cost of this project is Rp 21,400,652,629.00. This project saves 52 working days can be seen in Table 4.

So that it can be known the difference / savings obtained from the application of the CCPM method is Rp. 1,215,066,667.-

Table 4.
Costs Differences

Without CCPM	168	Rp 3.925.600.000
50% Probability	81	Rp 1.892.700.000
With Resource Levelling	99	Rp 2.313.300.000
With Buffer	116	Rp 2.710.533.333
Difference/Savings	168-116	Rp 1.215.066.667

IV. CONCLUSION

Rescheduling with the CCPM method in the case study of this study found the following conclusions and suggestions:

1. The project can reduce work time by 52 days from the previously scheduled time of 168 days;
2. The project can save workers wage costs for 52 days as much as Rp. 1,215,066,667
3. Reducing the probability of 50% on each job must consider the quality of work produced because by reducing the duration of work time, the quality of work is also reduced. So we need a job analysis where there is no 50% reduction in probability

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