Construction Delays Analysis in the Kampung Akuarium Flats Project, Penjaringan-Jakarta

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Received 16 September 2023; received in revised form 27 September 2023; accepted 28 September 2023

Abstract

The most common impediment to project work is a delay in implementing work activities. Even though the completion time has been calculated, there are several influencing factors, such as natural factors that cannot be predicted, late material delivery, a lack of workers that are not optimal when doing project work, and insufficient funds. In this case, the construction project of the Kampung Akuarium flats in Penjaringan area of North Jakarta was delayed from both technical and non-technical. The objective of this study is to identify the factors causing the project delays and the delay time of the project. This research was conducted by collecting data obtained and processed using Microsoft Project 2019 and the Critical Path Method (CPM) to help identify the problems. From the results that have been analyzed, critical paths include the structural work, finishing architecture 3rd floor, finishing architecture 4th floor, and finishing architecture 5th floor. If not completed immediately or delayed during implementation, the entire project schedule will be delayed. This has an effect where the initial contract plan was completed in 182 days to 259 days with a difference of 77 days or 11 weeks.

Keywords: delay analysis, flats, Kampung Akuarium, Critical Path Method, Microsoft Project

1. Introduction

A construction project is an activity carried out within a limited period, with certain resources, to achieve results agreed upon by both parties, namely the owner and contractor. Implementation according to UUJK (Construction Services Act) No.18/1999 article VI, namely a series of planning as well as implementation and supervision covering architectural, civil, mechanical, electrical, and environmental planning work and their accessories, has the same function to support the realization of national development. The community can benefit from this development's results and produce people's prosperity and welfare.

On the other hand, conditions and situations that can impede an entire project can result in delays in completing the work so the time that has been planned in the contract document is not appropriate which causes material and time losses. In general, the causes of delays are the problem of late delivery of materials, lack of construction workers, natural disasters, and the environment that is difficult to access [1]. For example, the construction of Kampung Akuarium flats located in Penjaringan of North Jakarta, was built on a land area of 10.420 m^2 with an initial plan of 5 towers with a split floor concept. The project's initial plan starts on February 14, 2022, and uses the Lump Sum Fixed Price contract. The project experienced delays for months and caused losses to many parties.

Critical Path Method (CPM) is a time-oriented method, with a path that has a series of activity components with the longest total consisting of critical series starting from the beginning of the activity until the last activity. The Critical Path

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method can help determine work activities that are a priority to be completed first to minimize delays on projects [2-3]. Therefore, it helps researchers analyze the implementation of activities with a critical path through a Network Diagram.

Based on the background exposure that has been described, this research aims to identify the factors causing the project delays and the delay time of the project. To analyze the construction delay, this study was conducted using the Microsoft Project application by analyzing the delay with the Critical Path Method.

2. Method

The methodology of this study is shown in Fig. 1. Then, the method of this study is described as follows. Identifying delay factors is necessary so that in the future, we can avoid the same problems that are detrimental to both parties and speed up the project schedule or the initial plan that has been determined. A successful project is a project that is completed on time, the quality used is maintained, and the incoming and outgoing budget can be controlled [4]. The way to minimize the possibility of delays in project completion is to analyze and identify problems using general data related to the project completion schedule, such as the S-curve that will be calculated to find the critical path using the help of Microsoft Project software to analyze what happened during implementation base on general project data [5-6].

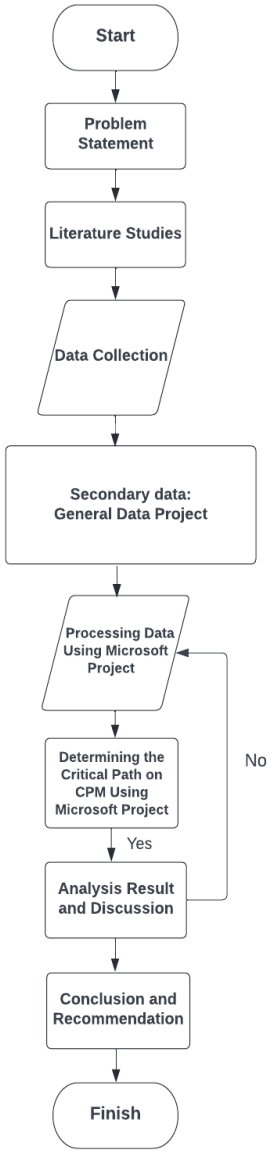


Fig. 1 Study Methodology

The Kampung Akuarium flats in the Penjaringan area of North Jakarta were first built on April 11, 2016, with a land area of 10.420 m² which is divided into 5 (five) towers, where 2 (two) have been built, and 3 (three) towers are under construction. The 2 (two) towers being worked on are under the ownership of PT. GS and PT. PIL and the task of constructing of 2 (two) towers are given to PT. TEP. The location of the flats project, as shown in Fig. 2. The S-curve of the project as seen in Fig. 3.

Fig. 2 Location of Kampung Akuarium flats

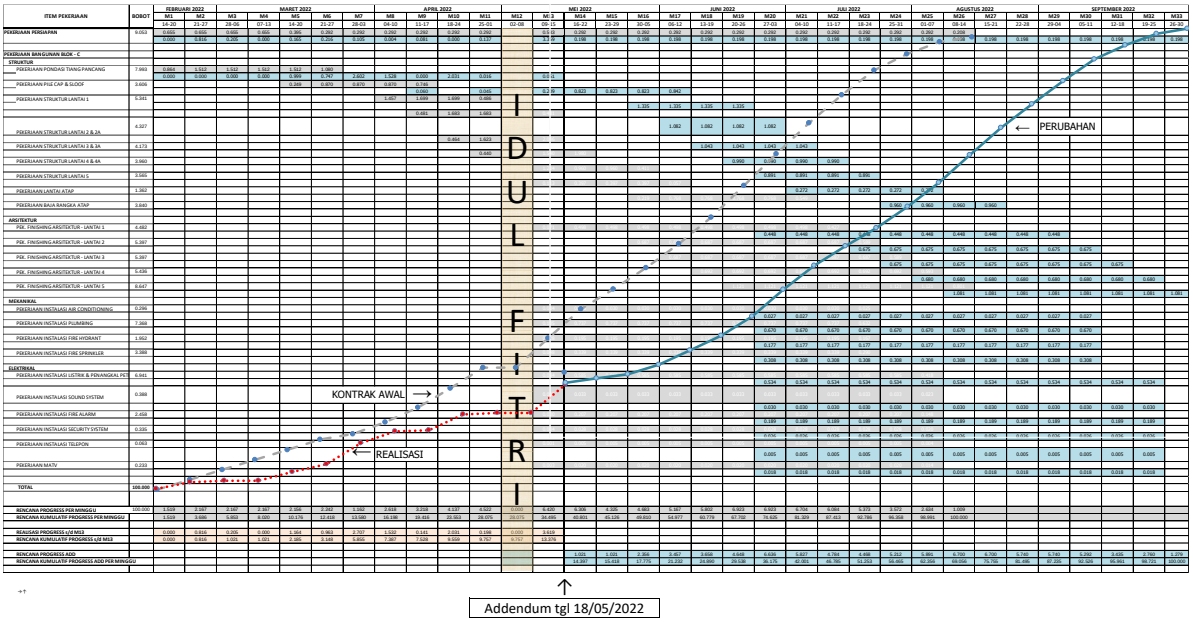


Fig. 3 The S-curve

Hanumm's first developed S-curve by observing several projects from the start of construction until the completed project. The S-curve is a graph that shows the progress of an ongoing project based on work time, work items, and weights in the form of a cumulative percentage of work. The S-curve is formed like the letter S and is formed from the progress of the project that goes up and down due to delays. S-curve can provide progress or delay of project by comparing it with the

initial plan, The S-curve is also referred to as a type of time control for something to be compared between the plan and the implementation of realization. The S-curve will help the Microsoft Project to process data using the Critical Path Method (CPM). The critical Path Method is a time-oriented method, with a path that has a series of activity components with the longest total consisting of critical series starting from the beginning of the activity until the last activity. The Critical Path Method can help determine work activities that are a priority to be completed first to minimize delays on projects [7-8]. Therefore, it helps researchers analyze the implementation of activities with a critical path through a Network Diagram. An example of the Critical Path Method as shown in Fig. 4, where ES is the early start, ID is the activity ID, EF is the early finish, SL is the slack time, LS is the late start, DUR is the duration, and LF is the late finish.

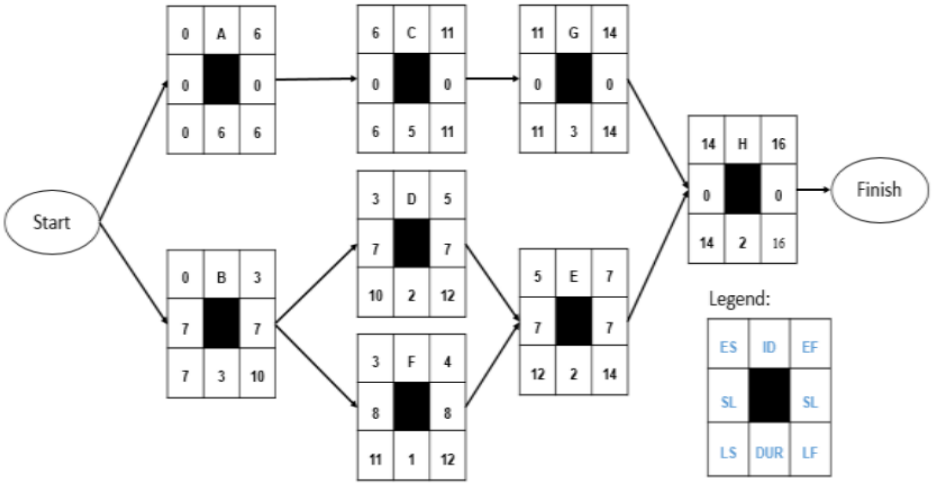


Fig. 4 Example of Critical Path Method [7].

3. Results and Discussion

Critical Path Methods is a mathematically based algorithm for set the project schedule activities by determining and calculating Early Start, Early Finish, Late Start, and Late Finish for all work activities without showing limited resources by analyzing the forward and backward passes on a scheduled network [9-10]. Early Start and Early Finish date of activities are calculated at the earliest possible time which means how early an activity can begin and finish (Forward pass). Late Start and Late Finish dates of activities are calculated at the latest possible time which means how late an activity can begin and be completed (Backward pass).

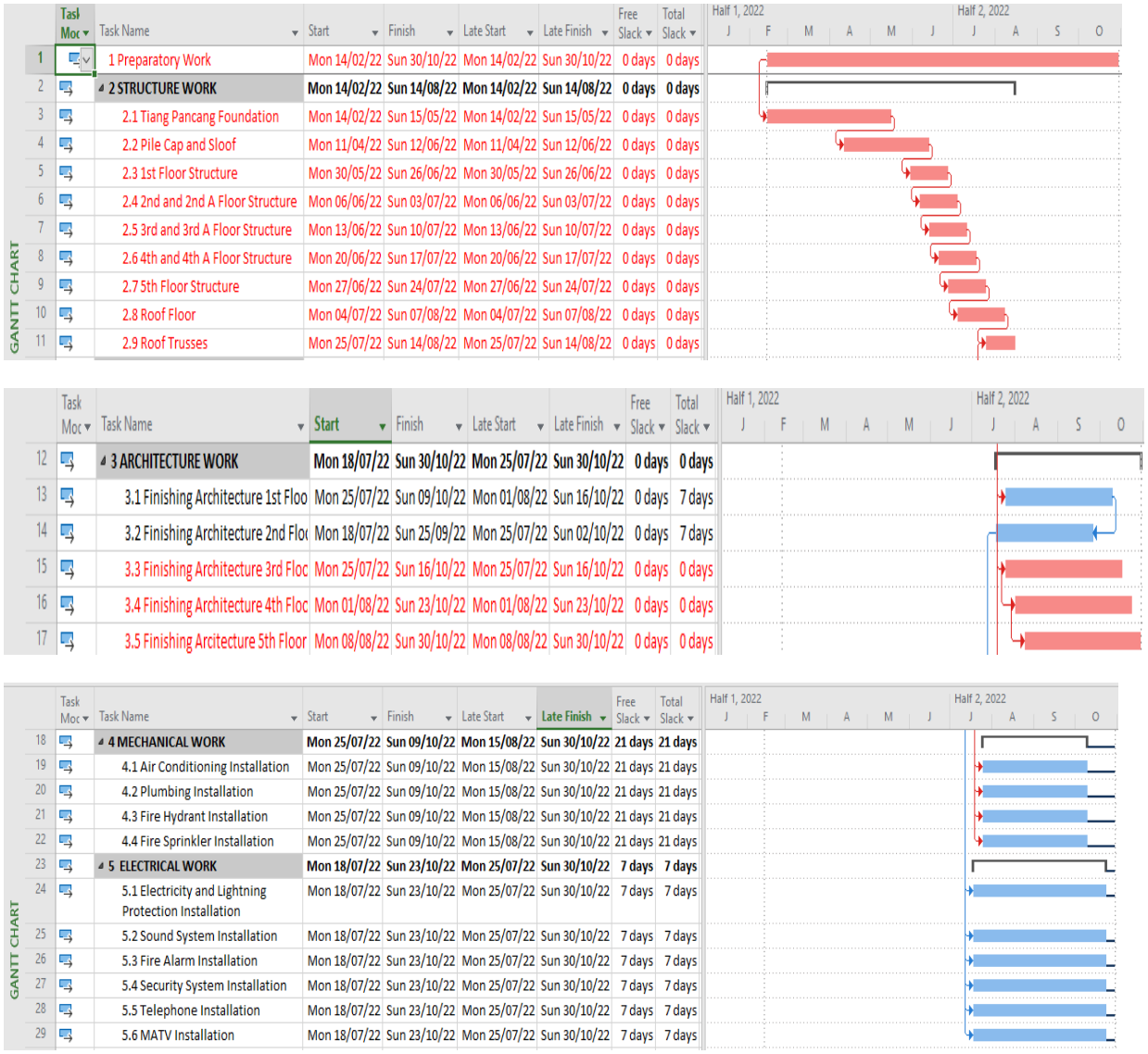
Float or slack is the tolerance limit for delays in activities in the form of time if there is a delay to start from Early Start but does not change the overall duration of the implementation, slack can be calculated by evaluating several work activities that can be postponed by finding the difference between Late Start, Early Start, and the duration. Float is divided into 2 parts as follows [10]. The first part is the free float (Subsequent tasks), where the amount of time in an activity that can be postponed without affecting the next activities, is expressed as follows.

$$FF = Early\ Start\ (of\ successor) - Early\ Finish\ (of\ current)$$

The second part is the total float (Project completion), where the amount of time in an activity that can be late without affecting the project finish date, is shown below.

$$TF = Late\ Start - Early\ Start$$

The realization of time schedule in this project is indicated in Fig 5. The time schedule includes the activities of preparatory work, structure work, architecture work, mechanical work, and electrical work.



	Task Mode	Task Name	Start	Finish	Late Start	Late Finish	Free Slack	Total Slack
1		1 Preparatory Work	Mon 14/02/22	Sun 30/10/22	Mon 14/02/22	Sun 30/10/22	0 days	0 days
2		**2 STRUCTURE WORK**	**Mon 14/02/22**	**Sun 14/08/22**	**Mon 14/02/22**	**Sun 14/08/22**	**0 days**	**0 days**
3		2.1 Tiang Pancang Foundation	Mon 14/02/22	Sun 15/05/22	Mon 14/02/22	Sun 15/05/22	0 days	0 days
4		2.2 Pile Cap and Sloof	Mon 11/04/22	Sun 12/06/22	Mon 11/04/22	Sun 12/06/22	0 days	0 days
5		2.3 1st Floor Structure	Mon 30/05/22	Sun 26/06/22	Mon 30/05/22	Sun 26/06/22	0 days	0 days
6		2.4 2nd and 2nd A Floor Structure	Mon 06/06/22	Sun 03/07/22	Mon 06/06/22	Sun 03/07/22	0 days	0 days
7		2.5 3rd and 3rd A Floor Structure	Mon 13/06/22	Sun 10/07/22	Mon 13/06/22	Sun 10/07/22	0 days	0 days
8		2.6 4th and 4th A Floor Structure	Mon 20/06/22	Sun 17/07/22	Mon 20/06/22	Sun 17/07/22	0 days	0 days
9		2.7 5th Floor Structure	Mon 27/06/22	Sun 24/07/22	Mon 27/06/22	Sun 24/07/22	0 days	0 days
10		2.8 Roof Floor	Mon 04/07/22	Sun 07/08/22	Mon 04/07/22	Sun 07/08/22	0 days	0 days
11		2.9 Roof Trusses	Mon 25/07/22	Sun 14/08/22	Mon 25/07/22	Sun 14/08/22	0 days	0 days
12		**3 ARCHITECTURE WORK**	**Mon 18/07/22**	**Sun 30/10/22**	**Mon 25/07/22**	**Sun 30/10/22**	**0 days**	**0 days**
13		3.1 Finishing Architecture 1st Floo	Mon 25/07/22	Sun 09/10/22	Mon 01/08/22	Sun 16/10/22	0 days	7 days
14		3.2 Finishing Architecture 2nd Floo	Mon 18/07/22	Sun 25/09/22	Mon 25/07/22	Sun 02/10/22	0 days	7 days
15		3.3 Finishing Architecture 3rd Floo	Mon 25/07/22	Sun 16/10/22	Mon 25/07/22	Sun 16/10/22	0 days	0 days
16		3.4 Finishing Architecture 4th Floo	Mon 01/08/22	Sun 23/10/22	Mon 01/08/22	Sun 23/10/22	0 days	0 days
17		3.5 Finishing Arcitecture 5th Floor	Mon 08/08/22	Sun 30/10/22	Mon 08/08/22	Sun 30/10/22	0 days	0 days
18		**4 MECHANICAL WORK**	**Mon 25/07/22**	**Sun 09/10/22**	**Mon 15/08/22**	**Sun 30/10/22**	**21 days**	**21 days**
19		4.1 Air Conditioning Installation	Mon 25/07/22	Sun 09/10/22	Mon 15/08/22	Sun 30/10/22	21 days	21 days
20		4.2 Plumbing Installation	Mon 25/07/22	Sun 09/10/22	Mon 15/08/22	Sun 30/10/22	21 days	21 days
21		4.3 Fire Hydrant Installation	Mon 25/07/22	Sun 09/10/22	Mon 15/08/22	Sun 30/10/22	21 days	21 days
22		4.4 Fire Sprinkler Installation	Mon 25/07/22	Sun 09/10/22	Mon 15/08/22	Sun 30/10/22	21 days	21 days
23		**5 ELECTRICAL WORK**	**Mon 18/07/22**	**Sun 23/10/22**	**Mon 25/07/22**	**Sun 30/10/22**	**7 days**	**7 days**
24		5.1 Electricity and Lightning Protection Installation	Mon 18/07/22	Sun 23/10/22	Mon 25/07/22	Sun 30/10/22	7 days	7 days
25		5.2 Sound System Installation	Mon 18/07/22	Sun 23/10/22	Mon 25/07/22	Sun 30/10/22	7 days	7 days
26		5.3 Fire Alarm Installation	Mon 18/07/22	Sun 23/10/22	Mon 25/07/22	Sun 30/10/22	7 days	7 days
27		5.4 Security System Installation	Mon 18/07/22	Sun 23/10/22	Mon 25/07/22	Sun 30/10/22	7 days	7 days
28		5.5 Telephone Installation	Mon 18/07/22	Sun 23/10/22	Mon 25/07/22	Sun 30/10/22	7 days	7 days
29		5.6 MATV Installation	Mon 18/07/22	Sun 23/10/22	Mon 25/07/22	Sun 30/10/22	7 days	7 days

Fig. 5 Time Schedule Realization R2

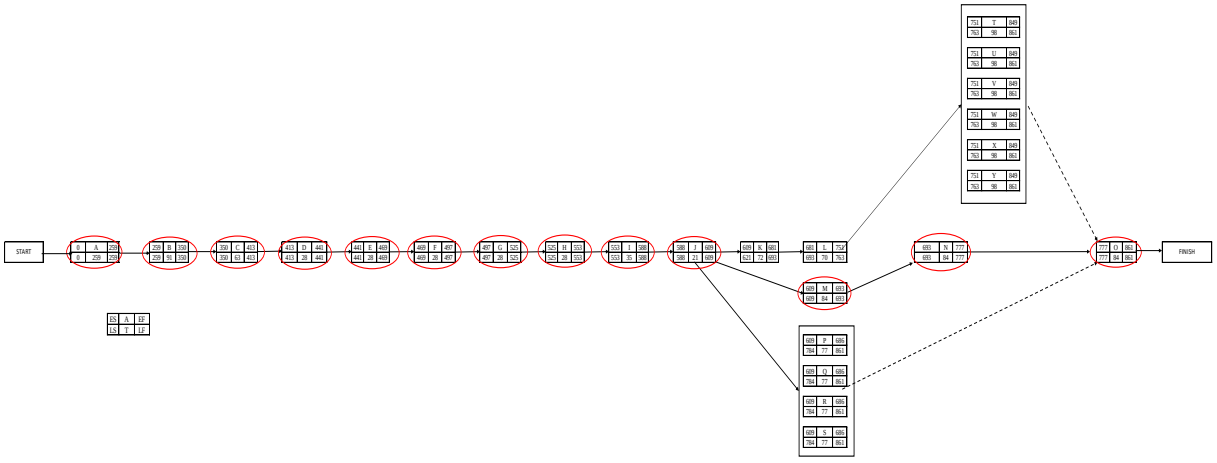


Fig. 6 Critical Path Diagram

Network analysis (Fig. 6) is part of the critical path by searching for Early Start, Early Finish, Late Start, and Late Finish for all activities without showing resource constraints using forward and backward passes analysis, after which calculating floats in the form of activity delay limit tolerances.

4. Conclusions

Projects that experience delays that are not by predetermined plans can be analyzed in the real-time schedule using Microsoft Project software to find out work activities that are very influential in the successful completion of the project. The Microsoft project software using Critical Path Method (CPM) can find a critical path on a project. Suppose all structural and architectural finishing work of the 3rd floor, 4th floor, and 5th floor are not carried out immediately or are delayed during implementation. In that case, it will delay the completion of the whole project. The initial plan for Kampung Akuarium flats project can be completed in 182 days starting from February 14, 2022, to August 14, 2022, experiencing delays with 2 new reference schedule revisions to 259 days from February 14, 2022, to October 30, 2022. It can be concluded that the difference is 77 days or 11 weeks.

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