

PROJECT SCHEDULING WITH CPM AND PERT METHODS ON THE PT. JAKARTA INDUSTRIAL ESTATE PULOGADUNG MOSQUE CONSTRUCTION PROJECT

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ABSTRACT

Project implementation requires accurate planning, scheduling, and management, covering various aspects such as resources, availability of materials, equipment, natural conditions, weather, and other factors that affect project development. Project planning reflects the relationship between activities and the overall project sequence, and helps in prioritizing the relationship between activities. Various methods are available to analyze project schedules. This research uses the Critical Path Method and Program Evaluation and Review Technique, which is slightly different from the approach used in the construction of the Mosque at PT Jakarta Industrial Estate Pulogadung. In this study, Microsoft Project software was used for the calculation of CPM and PERT methods. Based on the analysis results, 6 work items were found to be on the critical path, namely: preparatory work, lower structure, upper structure, architecture, hardscape and softscape. The project completion time is estimated to be 105 days with the CPM method and 101 days with the PERT method, with a project completion opportunity of 37.37%.

Keywords: projects, CPM and PERT, construction

INTRODUCTION

Project implementation requires proper planning, scheduling, and management, which includes aspects of resources, availability of materials, equipment, natural conditions, climate, and other factors that can affect project development. These factors not only impact the progress of the project, but can also cause delays as well as completion times that exceed the predetermined schedule. If problems occur in a project, it will affect its smooth implementation. If the project fails to be implemented, then the previously set goals will also fail, which ultimately leads to a waste of time and money. Project planning describes the relationship between activities as well as the entire project sequence, and helps in prioritizing the relationship between activities. There are various approaches that can be used to analyze project schedules. This research applies the CPM and PERT methods which have slight differences compared to the planning methods applied to the construction of the PT JIEP Mosque.

METHOD

Researchers conducted research for 2 months, while the location of the research object can be seen in the picture below:



Figure 1. Research Location

The data collection method used is to find information related to the construction of the PT JIEP Mosque in East Jakarta. The data required in this study includes secondary data, such as S-Curve graphs or Time Schedules, as well as supporting data from other projects. Data processing is an important step in analyzing the information obtained. Data analysis in this study is focused on the time period of the PT JIEP East Jakarta Mosque construction project by applying the CPM and PERT methods. After the data is collected, the processing is done using the help of Microsoft Project software.

RESULTS AND DISCUSSION

The CPM analysis includes the calculation of work duration by taking into account early start, latest finish, early finish, and latest start for each activity. Next, forward and backward calculations are performed, along with total float calculations, to identify the critical path of each activity. The purpose of this process is to determine the critical path for each job. The initial work is to assign work code items to each activity.

Table 1. Work Code Items

Nomor	Item Kegiatan	Kode Pekerjaan
1	Pekerjaan persiapan	A
2	Struktur bawah	B
3	Struktur atas	C
4	Arsitektur	D
5	Hardscape	E
6	Softscape	F
7	Mechanical	G
8	Electrical	H
9	Plumbing	I

The next step is to ensure the duration (time) of each project work activity on the PT JIEP East Jakarta Mosque construction project.

Table 2. Work Time

Nomor	Item Kegiatan	Durasi (hari)
1	Pekerjaan persiapan	101
2	Struktur bawah	57

3	Struktur atas	67
4	Arsitektur	77
5	Hardscape	87
6	Softscape	87
7	Mechanical	100
8	Electrical	98
9	Plumbing	87

To develop a schedule, the first step is to determine the duration of each job, then connect the activities logically. The author uses Microsoft Project software to analyze duration and critical path. After the required information is collected, the next step is to enter the data into the Microsoft Project program. From this, it can be ascertained that the PT JIEP East Jakarta Mosque construction project will be completed within 101 days. The results of scheduling analysis using Microsoft Project can be presented in the form of barcharts and network diagrams.



Figure 1. CPM Network Diagram

Based on the picture above, it can be seen that there are 6 critical work items or included in the critical path.

Analysis with the PERT method is carried out to estimate the possibility of project completion. Unlike the CPM which relies on exact time, the PERT method uses three types of duration estimates, namely:

- 1) Best time (A);
- 2) The most likely time (M);
- 3) The worst time (B).

The analysis results provide optimistic, realistic, and pessimistic time estimates for the PT JIEP East Jakarta Mosque construction project.

Table 3. Calculation of Work Duration Processed with PERT Method

Nomor	Item Kegiatan	Kode Pekerja	A	M	B
1	Pekerjaan persiapan	A	101	102	103
2	Struktur bawah	B	113	115	121
3	Struktur atas	C	113	115	121
4	Arsitektur	D	87	91	111
5	Hardscape	E	23	25	37
6	Softscape	F	21	27	25
7	Mechanical	G	105	107	109
8	Electrical	H	105	107	109
9	Plumbing	I	105	107	109

Arranging the relationship between activities aims to understand the relationship between activities that have been carried out and activities that will come. The following is a series of interdependent activities in the PT JIEP East Jakarta Mosque construction project. The order of these activities is arranged based on the relationship between activities in the project.

Table 4. Interrelationships between Work Implementation Items

Nomor	Item Kegiatan	Kode Pekerjaan	Durasi	Pekerjaan Terdahulu
1	Pekerjaan persiapan	A	101	-
2	Struktur bawah	B	113	A start to start + 15 days
3	Struktur atas	C	113	B start to start + 97 days
4	Arsitektur	D	87	C start to start + 21 days
5	Hardscape	E	23	D finish to start + 79 days
6	Softscape	F	21	E finish to start + 88 days
7	Mechanical	G	105	G start to start + 71 days
8	Electrical	H	105	H finish to start + 95 days
9	Plumbing	I	105	H finish to start – 101 days

In preparing the schedule, the first step is to determine the duration of each job, then connect the activities based on the logic of linkage. The author utilizes Microsoft Project software to analyze the duration and identify the critical path. After collecting the necessary information, the next step is to enter the data into Microsoft Project software. From the analysis conducted, it can be ascertained that the PT JIEP East Jakarta Mosque construction project can be completed in 101 days. The scheduling results analyzed with the help of Microsoft Project can be presented in the form of barcharts and network diagrams.

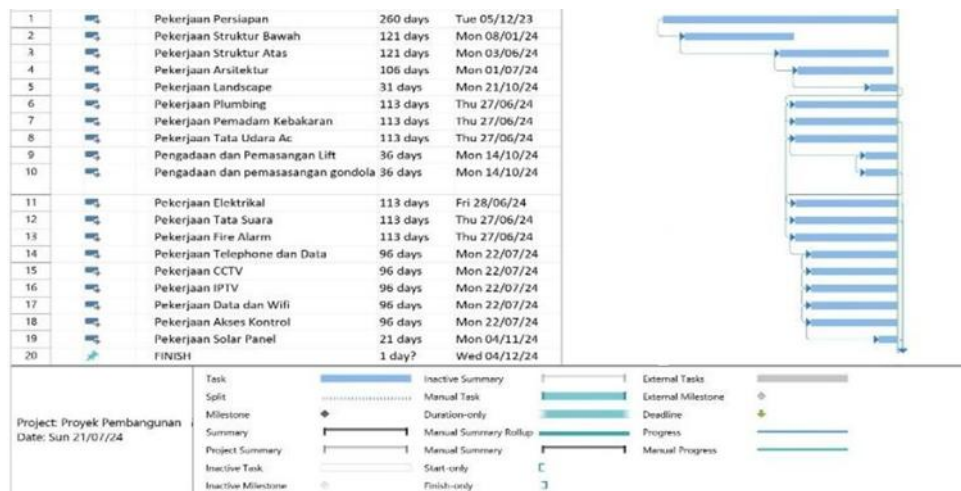


Figure 2. CPM Scheduling Using MS Project

Determining the probability, after getting the standard deviation, the next step is to determine the probability of completion of the PT JIEP East Jakarta Mosque construction project.

$$Z = \frac{T(d) - T_e}{s}$$

$$Z = \frac{101 - 102}{6}$$

$$Z = -0,1667$$

CONCLUSIONS

Based on the results of the analysis, six work items were found to be on the project's critical path. These work items include preparatory work, which includes the initial stages of project implementation; lower structure, which consists of foundation work and other supporting elements; upper structure, which includes building frames and other structural elements; architectural work, which deals with the design and aesthetics of the building; and hardscape and softscape work, which includes hard landscape elements such as walkways, sidewalks, and soft elements such as gardens and vegetation. Based on the results of calculations using the Critical Path Method (CPM), the project is estimated to be completed within 105 days. Meanwhile, using the Program Evaluation and Review Technique (PERT) method, the project completion time is estimated to be shorter, which is 101 days. From the results of the probability analysis conducted, it was found that the probability of successful completion of the project within the specified time was 37.37%. This indicates that there is a risk of delay that needs to be considered in overall project planning and management.

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