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Scheduling Analysis of the Grand Shamaya Apartment Basement Development Project in the Midst of a Pandemic Using the First Method

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Abstract

In planning and controlling a project, it is often faced with various obstacles, for example, there is a shortage of materials, errors in the work order. In this project there was a delay due to a pandemic which caused the project to be hampered which initially could run according to schedule but became not according to the specified schedule. To minimize the impact of risks that occurred, a project scheduling method was developed using a probabilistic duration, one of which was PERT (Program Evaluation and Review Technique). In this study, PERT (Program Evaluation and Review Technique) simulation was implemented which was implemented in the Grand Shamaya basement construction project based on the optimistic, pessimistic, and possible durations obtained from the survey results by the project management. PERT calculation using Microsoft Project 2013 software which produces an optimistic duration of 530 days, then for a possible duration of 535 days, a pessimistic duration of 551 days, and finally for a simulation result duration of 534.6 days. The difference in the schedule for the basement construction project of the Grand Shamaya Surabaya apartment when compared to scheduling using the PERT (Program Evaluation and Review Technique) method is the length of duration and the probability of project completion. So the duration of the plan schedule for 535 days produces a probability of 53.19%. The difference in the schedule for the basement construction project of the Grand Shamaya Surabaya apartment when compared to scheduling using the PERT (Program Evaluation and Review Technique) method is the length of duration and the probability of project completion. So the duration of the plan schedule for 535 days produces a probability of 53.19%. The difference in the schedule for the basement construction project of the Grand Shamaya Surabaya apartment when compared to scheduling using the PERT (Program Evaluation and Review Technique) method is the length of duration and the probability of project completion. So the duration of the plan schedule for 535 days produces a probability of 53.19%.

Keywords:
Microsoft Project 2013, Microsoft Project 2013, PERT, Project Management, Project Scheduling,

1. Introduction

In project implementation, it often happens that what has been done does not go according to plan, for example the implementation of the Grand Shamaya basement apartment development project has experienced delays in its work due to PSBB (Large-Scale Social Restrictions) as a result of the COVID-19 pandemic that emerged in early 2020 A situation like this if it occurs in a work organization that has many activities, delaying the completion time in one activity will result in a delay in the completion time of the next activities. The more activities whose completion is not in accordance with the initial plan, the greater the total time required to complete the project (Retno Maharesi, 2002)

This is what underlies the use of the PERT (Program Evaluation and Review Technique) method in scheduling. Determining the duration of a project's activities using the PERT method is estimated by three estimation parameters, namely the fastest time (optimistic duration time), the longest time (pessimistic duration time) and the most likely time (most likely time).

Based on the description above, this final project will analyze project scheduling using the PERT method, with a case study on the construction of the Grand Shamaya apartment basement with a child contract value of 142 billion. By using the PERT method, it is hoped that it will simplify the scheduling process and be able to find out the fastest work that can be done to catch up with the PSBB.

2. Literature Review

2.1. Project Scheduling

The schedule is the elaboration of project planning into a sequence of steps for implementing work to achieve goals. The time factor has been included in the schedule. A well-known method of constructing a schedule is network analysis, which depicts on a graph the relationships of the project work sequences. Jobs that must precede or be preceded by other jobs are identified in terms of time. This network is very useful for project planning and control (Iman Soeharto, 1997)

2.2. CPM Method (Critical Path Method)

According to Pardede (2014), the CPM method (critical path method) is a method using arrow diagrams in determining the critical path, so it is also called the critical path method. CPM uses one number to estimate the duration of a certain activity (deterministic). Here's the form of CPM:

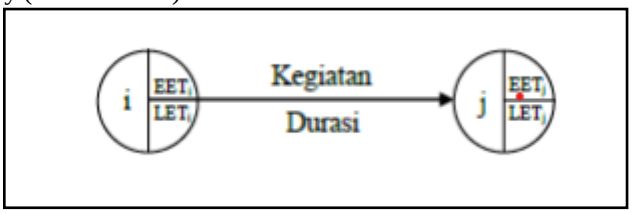

Figure 1. AOA (Activity On Arrow) Diagrams
(source: Husen, 2008)

2.3. PDM method

The Precedent Diagram (PDM) method was introduced by JWFondahl from Stanford University, USA in the early 1960s. Subsequently developed by the IBM company. PDM is a network that is generally rectangular in shape, while the arrows are only a guide for the activities concerned, and do not require dummy activities. In PDM a new activity can be started without waiting for the predecessor activity to be completed 100%.

2.4. PERT Method (Program Evaluation and Review Technique)

The PERT method is a way of planning with work networks that are connected with certain considerations. This method like CPM (Critical Path Method) requires several parameters, one of which is activity duration. Determination of activity duration in CPM refers to a fixed duration, meaning that it is enough to estimate one activity duration. The characteristics of the project cause the duration of the activity to be uncertain because the duration of the activity is influenced by various varying conditions. The PERT method assumes the duration of the activity as probabilistic (stochastic) because construction activities vary.

2.5. PERT Method Steps

The outline of the PERT and CPM methods according to (Stevens, 1990) almost the same in network management. The difference lies in determining the duration of the activity and the duration of the critical path. The outline of the PERT Method is as follows:

1. Determination of activities and their duration. PERT uses three assumptions for activity duration, namely to (optimistic time), tp (pessimistic time), and tm (most likely time).
2. Correlation of time with continuous distribution, and determine expected time (te), standard deviation (se), and variance (ve).
3. Expected time (te) is determined as the duration of the activity, then the critical path is searched as in CPM.
4. Determine the project duration of the critical path

Determination of to, tp, and tm is the first step of PERT, because these three time assumptions determine te. The three durations are assumed to be functions or generalizations of the beta distribution with the activity duration variable, which means that PERT duration is statistical data that does not go out of its distribution area. The beta distribution function is used as the basis for determining the duration (te) , standard deviation (se), and variance (ve) of PERT as follows:

$$te=((to+4m+tp))/6 \quad (1)$$

$$se=((tp-to))/6 \quad (2)$$

$$ve=((tp-to))/6⟧\ ^2 \quad (3)$$

Description:

te: expected Time	tp: pessimist time
to: optimistic Time	se:standard deviation
m: Most Likely	ve: variation

3. Research Methodology

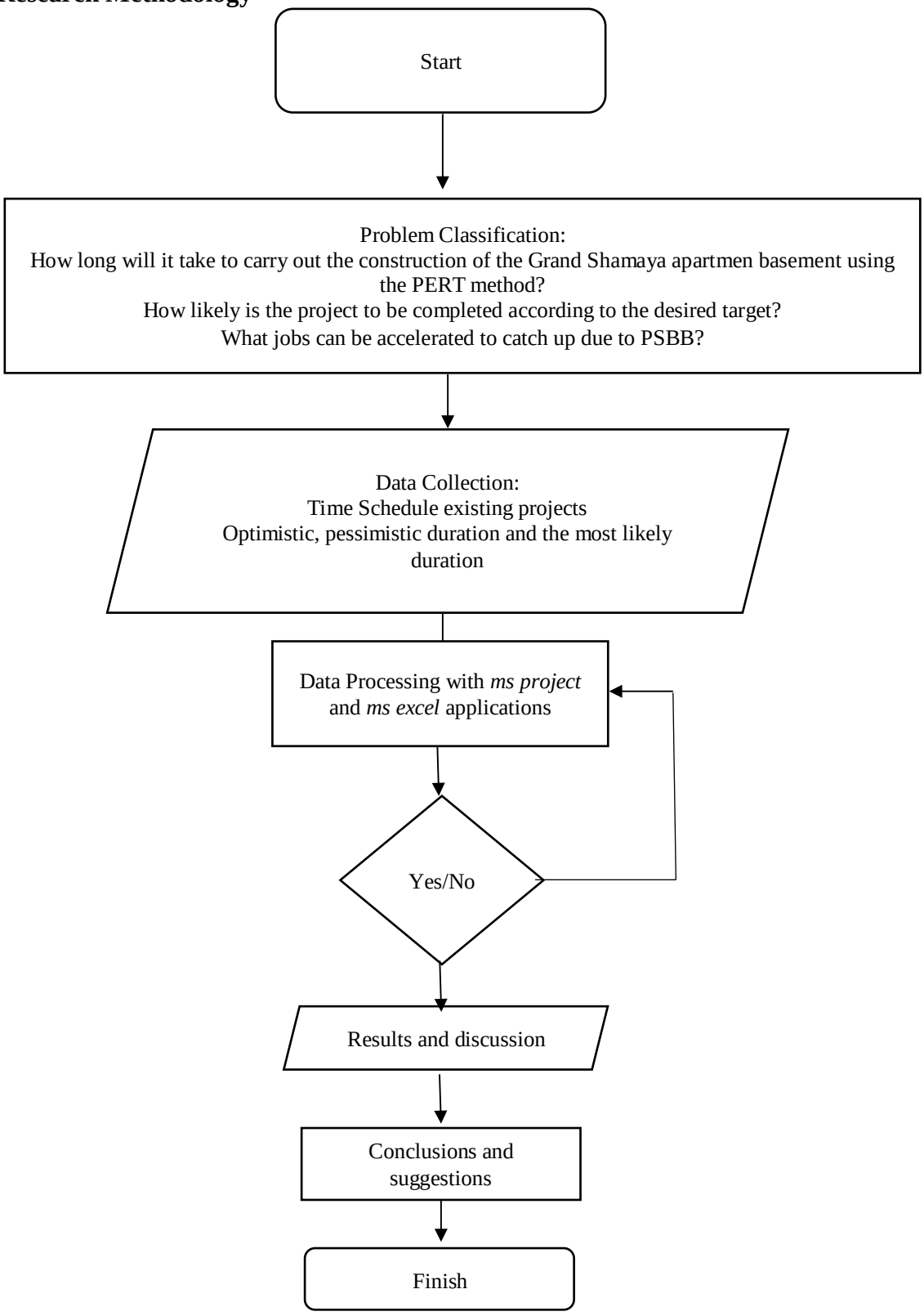

Figure 2 Research Flowchart

4. Results And Discussion

4.1. Research sites

The project site is located on Jl. Embong Sawo No.1, Embong Kaliasin, Kec. Tile, Surabaya City, East Java. The location of this apartment is very strategic because it is located in the middle of the city of Surabaya and around the office area.

Figure 3 Grand Shamaya Apartment Project Location

4.2. Data analysis

The research data was taken from the grandshamaya apartment construction project which was the result of interviews with the project management. The data obtained are pessimistic duration (tp), optimistic duration (to), and possible duration (tm). Here's Table 1.

Table 1. Data optimistic time (to), most likely time (tm) and pessimistic time (tp)

No.	Job description	Duration		
		to	Tm	tp
A	Substructure WORKS			
1	EXCAVATION WORKS (PC RATE)			
	Basement 1 level -3,300 to +1,150	112	120	127
2	CUTTING OFF PILE HEAD			
	Main Bore Pile 1200mm	83	90	95
	TestPile&ReactionPileØ1200mm	174	180	183
	SecantPileØ1200mm	88	93	95
3	Reinforced Concrete Fc 35 Mpa			
	Beam - Basement 1	111	120	125
	Slab - Basement 1	111	120	125
4	Formwork			
	beam - Basement 1	111	120	125
	Slab - Basement 1	111	120	125
5	REBAR			
	Beam - Basement 1	281	292.5	300
	Slab - Basement 1	281	292.5	300

6	SECANT PILE JOINT SLAB			
	Hilti RE500 Epoxy incl. Drill Length=2m	111	120	127
	SIKASWELL- Basement 1	111	120	127
	SIKAFUCA - PC RATE - Basement 1	111	120	127
`	DEWATERING			
	Surface Dewatering	321	330	337
	Deep well Dewatering	321	330	337
B	ADITIONAL WORKS (PROVSUM)			
1	BORED PILE & KING POST	1	1.5	3
2	COUPLER (PROVSUM)			
	D22	1	1.5	3
	D25	1	1.5	3
	D32	1	1.5	3
3	CAPPING BEAM			
	Excavation	97	105	110
	Backfill	52	60	66
	Concrete Fc' 35 Capping Beam	211	225	234
	Concrete Fc' 35 Secant Pile add	211	225	234
	Demolished Capping Beam	9	15	20
	Formworks capping Beam	215	225	234
	Rebar	215	225	234
	Demolished Platform	123	135	144
4	STEEL ACCESS RAMP (PROVSUM)	9	15	20
5	FORMWORK SCAFFOLDING (PROVSUM)	128	135	140
C	VARIATION WORKS			
1	inclinometer	169	180	189
2	Sparring Capping Beam	19	30	40
3	Demolished Guidewall	49	60	70
4	Stampcold Coupler	23	30	35

5	Steel Strut	11	18	24
6	Floor Hardener	115	120	125
7	Gusette on King Post	115	120	125
8	Concrete for Column Head Shearwall B1	112	120	125
9	Fromwork for Column Head& Shearwall B1	112	120	125
10	Rebar for Column Head & Shearwall B1	112	120	125
11	wall beam calculation			
	Rebar	112	120	125
	Formwork	112	120	125
	Concrete	112	120	125

4.3. Determining the Expected Time Duration (Te)

After getting data on optimistic time (to), pessimistic time (tp), and possible time (tm). Then the next step is to determine the expected time duration (te). The expected duration can be calculated using the following formula:

te=((to+4.tm+tp))/6(4)

Calculation (te) for Basement 1 level work -3300 to +1150

Optimistic duration (to) = 112

Duration allows (tm) = 120

Pessimistic duration (tp) = 127

So,

te=((to+4.tm+tp))/6=((112+(4.120)+127))/6=719/6=119.8 (5)

4.4. Determining Deviation And Variance

After determining te the next step is to determine the deviation and variance. The formula used to calculate variance and deviation is as follows:

Standard Deviation (se) = (tp-to)/6

Variant (ve) = (se)^2

Calculations For Basement 1 Level Work -3,300 To +1,150

Optimistic duration (to) = 115

Duration allows (tm) = 120

Pessimistic duration (tp) = 125

Then, the standard deviation (se) = (tp-to)/6

= (125-115)/6 = 1.67

Variant (ve) = (se)^2

= 1.67⟧ ^2= 2.78

4.5. Project life based on PERT method

After determining te the next step is to determine the deviation and variance. The formula used to avoid From the probability curve can be seen:

1. The minimum value of the total project duration is 530 days
2. The mean value of the total duration is 535 days
3. The maximum value of the total duration is 551 days
4. The duration of project completion using a probabilistic method is 535 days with a contingency of 4 days.

From the distribution of project duration completion, the expected duration (td) at the 53.19% percentile is taken, which is 535 days. While the time contingency is taken from the 83.33% percentile minus the 53.19%

percentile, which is 4 days. Taking this time contingency due to the 83.33% percentile where time has a high chance of occurrence. The calculation of variance and deviation is as follows:

4.6. Calculating Project Completion Probability

From the results of the analysis of the PDM network in the previous stage, it was obtained that a critical cross was obtained, so that we can see the age of the project and what activities are classified as critical activities. Furthermore, it can be used to determine the probability duration with the formula:

z=(Td-Te)/(Se LK)=

z=(534-534.6)/4.96=0.08

From the Appendix II table obtained: P (Z = 0.08) = 0.5319 = 53.19%

5. Conclusion

Grand Shamaya Apartment Basement can be concluded as follows:

1. From the results of probabilistic analysis, the project age is 535 days with a contingency of 4 days 53.19%
2. From the results of the above analysis, the critical activities in the project are:
    a. Basement excavation work level 1 -3,300 to +1,150
    b. Reinforced Concrete Fc 35 Mpa beam - Basement 1
    c. Formwork beam - Basement 1
    d. Steel Strut
    e. Floor hardener
3. In the PERT calculation above, the project age is 535 days, while the actual schedule is 598.5 days

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Biography

Bayu Arkan Pambudi,was born in Karawang City on August 21, 1999. The last child of three siblings. The author completed his education at the Ngagelrejo I State Elementary School Surabaya in 2011 and continued the Ipiems Junior High School until 2014. Then he continued his Ipiems High School until 2017 and enrolled at the Narotama University Surabaya College of Civil Engineering Study Program, Faculty of Engineering and Computer Science. During my time at school I was actively involved in organizations and in college I also took part in the Faculty Student Executive Board.