VOLUME 22 | NUMBER 01 | JULY 2022
https://ejournal.worldconference.id/index.php/neutron
E-ISSN: 2685-3272 | P-ISSN 1412-0860

Cost and Time Performance Analysis on Controlling Contruction Projects with "PERT" Method (Case Study: Airlangga University Parking Building)

Achmad Safri Syamsudin, Julistyana Tistogondo, Diah Ayu Restuti Wulandari
Dapartement of Civil, Narotama University, Jl Arif Rahman Hakim No 51, 60117, Surabaya, Indonesia
safrisyam97@gmail.com, julistyana.tistogondo@narotama.ac.id

Abstract

In the matter of parking lot problems, there are many ways to solve the problems that always arise from the parking lot with more and more and require a very large land with adequate capacity, therefore one of them is by making a multi-storey parking building. The more development of construction work, the more problems that arise during construction, one of which is project management problems which before the implementation or implementation of development are always planned to determine the schedule, time, and cost needed. In the construction of the Airlangga University multi-storey parking building project, controlling the schedule of the plan should have been carried out in 300 days. With the CPM and PERT methods used, the calculation duration is 340 days with a probability of 99.85% to speed up work and delays. Acceleration is carried out by adding workers so that it will affect costs, so after adding workers with normal costs of Rp. 49.139.000.850,26. and after the addition of manpower to speed up the implementation time with a total cost of Rp 49,227,563,678.83. after accelerating.

Keywords :
Cost, PERT, Time

1. Introduction

A project is an organized effort to achieve important goals, objectives and expectations using the available budget and resources, which are adjusted to a certain time period. One type of project that is often found in our daily lives is the implementation of building construction projects .

In this study, Airlangga University parking building construction project was used as the object of research. Through this research, the researcher wants to know about the time and cost performance in the implementation of the building construction project. The reason the researcher chose the building construction project as the object of research was because of the suspicion that the implementation of the construction project had problems with delays in project completion time so that it also had an impact on project cost overruns.

2. Methodology

Program Evaluation Review Technique (PERT) is a network program that is used to plan and control the duration of a project, the stages of analyzing each activity with three scopes of time, namely optimistic time, pessimistic time, and realistic time to get an estimate of the expected time.

The results of this study become a reference for project implementers regarding building construction project management, which through the results of this study, project implementers can apply the PERT method as a construction project management technique, so as to avoid problems related to construction project time and cost

3. Results and Discussion

3.1. The possibility (probability)

The possibility (probability) of completing a project is an important thing that must be considered in making a work schedule. This is because every project implementation must have constraint factors so that these probabilities can be used to consider the possibility of completing the project faster, slower, or according to a predetermined schedule.

Table 1. The Possibility

NO	Completion Target	Z deviation	Cumulative Normal Distribution	Probability/Probability of the Project to be completed 100%
1	260	-2.9724	0.0015	0.15%
2	271	-2,1550	0.0158	1.58%
3	272	-2,0807	0,0188	1,88%
4	273	-2,0064	0,0228	2,28%
5	274	-1,9321	0,0268	2,68%
6	275	-1,8578	0,0322	3,22%
7	276	-1,7835	0,0375	3,75%
8	277	-1,7091	0,0446	4,46%
9	278	-1,6348	0,0516	5,16%
10	279	-1,5605	0,0594	5,94%
11	280	-1,4862	0,0694	6,94%
12	281	-1,4119	0,0793	7,93%
13	282	-1,3376	0,0918	9,18%
14	283	-1,2633	0,1038	10,38%
15	284	-1,1890	0,119	11,90%
16	285	-1,1147	0,1335	13,35%
17	286	-1,0404	0,1492	14,92%
18	287	-0,9660	0,1685	16,85%
19	288	-0,8917	0,1867	18,67%
20	289	-0,8174	0,209	20,90%
21	290	-0,7431	0,2296	22,96%
22	291	-0,6688	0,2546	25,46%
23	292	-0,5945	0,2776	27,76%
24	293	-0,5202	0,3015	30,15%
25	294	-0,4459	0,33	33,00%
26	295	-0,3716	0,3557	35,57%
27	296	-0,2972	0,3859	38,59%
28	297	-0,2229	0,4129	41,29%
29	298	-0,1486	0,4443	44,43%
30	299	-0,0743	0,4721	47,21%
31	300	0,0000	0,5	50,00%
32	301	0,0743	0,5279	52,79%
33	302	0,1486	0,5557	55,57%
34	303	0,2229	0,5871	58,71%
35	304	0,2972	0,6141	61,41%
36	305	0,3716	0,6443	64,43%
37	306	0,4459	0,67	67,00%
38	307	0,5202	0,6985	69,85%
39	308	0,5945	0,7224	72,24%
40	309	0,6688	0,7454	74,54%
41	310	0,7431	0,7704	77,04%
42	311	0,8174	0,791	79,10%
43	312	0,8917	0,8133	81,33%
44	313	0,9660	0,8315	83,15%
45	314	1,0404	0,8508	85,08%
46	315	1,1147	0,8665	86,65%
47	316	1,1890	0,881	88,10%
48	317	1,2633	0,8962	89,62%
49	318	1,3376	0,9082	90,82%
50	319	1,4119	0,9207	92,07%
51	320	1,4862	0,9306	93,06%
52	321	1,5605	0,9406	94,06%
53	322	1,6348	0,9484	94,84%
54	323	1,7091	0,9554	95,54%
55	324	1,7835	0,9625	96,25%
56	325	1,8578	0,9678	96,78%
57	326	1,9321	0,9732	97,32%
58	327	2,0064	0,9772	97,72%
59	328	2,0807	0,9812	98,12%

60	329	2,1550	0,9842	98,42%
61	330	2,2293	0,9864	98,64%
62	331	2,3036	0,9893	98,93%
63	332	2,3779	0,9911	99,11%
64	333	2,4523	0,9929	99,29%
65	334	2,5266	0,9941	99,41%
66	335	2,6009	0,9953	99,53%
67	336	2.6752	0.9962	99.62%
68	337	2.7495	0.9969	99.69%
69	338	2.8238	0.9976	99.76%
70	339	2.8981	0.9981	99.81%
71	340	2.9724	0.9985	99.85%

From the results of the analysis above, it can be seen that:

1. The probability that the project can be completed in 260 days is 0.15%.
2. The probability that the project can be completed in 300 days is 50%.
3. The probability that the project can be completed in 340 days is 99.85%.

This parking building construction project has activities that must be carried out systematically. After processing the data, the data obtained that the probability of project completion is 340 days with a probability of 99.85% possibility, therefore a method of accelerating the addition of workers is needed because the project stated in the contract document for the completion of the project is 300 days, by using the alternative of adding workers to the track activities. critical will make activities more quickly completed. In this case, the additional manpower is carried out by the project implementer according to the needs in the field. from the addition of labor there is an increase in the cost of the project.

3.2. Calculation Crash Duration and Crash Cost

Calculation Crash Duration and Crash Cost then carried out for the activities of all project activities, so that if recapitulation will get the value as following:

Tabel 2. Calculation Crash Duration and Crash Cost

No	Activity	Normal Duration (Day)	Normal Cost (Rp)	Crash Duration (day)	Crash Cost (Rp)
1	a.1	30.7	Rp 44,359,786.46	25.6	Rp 48,097,715.04
2	a.2	16.3	Rp 21,949,843.20	13.6	Rp 23,931,814.63
3	a.3	13.3	Rp 24,369,492.40	11.1	Rp 25,986,363.82
4	a.4	17.9	Rp 40,747,864.56	17.9	Rp 40,747,864.56
5	a.5	3.6	Rp 3,129,374,80	3.6	Rp 3 ,129,374, 80
6	a.6	14.0	Rp 44,752,500.00	14.0	Rp 44,752,500.00
7	b.1	45.7	Rp 127,615,924.12	45.7	Rp 127,615,924.12
8	b.2	31.4	Rp 30,085,949.32	26.2	Rp 33,910,806.46
9	b.3	30.7	Rp 387,198,576.93	25.6	Rp 390.936.505.50
10	b.4	21.3	Rp 27,418,127.04	21.3	Rp 27,418,127.04
11	b.5	13.0	Rp 17,773,587.05	10.8	Rp 19,355,687.05
12	c.1	110.9	Rp 11,270,434,768,64	110.9	Rp 11 ,270,434,768, 64
13	c.2	96.1	Rp 2,213,864,225,70	96.1	Rp 2 ,213,864,225, 70
14	c.3	90.0	Rp 67,263,489.25	90.0	Rp 67,263,489.25
15	c.4	84.3	Rp 2,126,538,256.58	84.3	Rp 2,126,538,256.58
16	c.5	95.9	Rp 760,187,704.53	95.9	Rp 760,187,704.53
17	c.6	88.3	Rp 1,161,381,099.39	88.3	Rp 1,161,381,099.39
18	c.7	76.0	Rp 1.042.015.286.16	76.0	Rp 1.042.015.286.16
19	c.8	80.3	Rp 3,667,379,488.01	80.3	Rp 3,667,379,488.01
20	c.9	46.6	Rp 108,621,701.63	38.8	Rp 114,289,444.49
21	c.10	76.7	Rp 554,786,237.07	76.7	Rp 554,786,237.07
22	c.11	36.0	Rp 64,212,328.93	30.0	Rp 68,593,528.93
23	c.12	36.0	Rp 128,561,346.56	30.0	Rp 132,942,546.56
24	d.1	45.4	Rp 1,161,381,099.39	45.4	Rp 1,161,381,099.39
25	d.2	45.4	Rp 1.042.015.286.16	45.4	Rp 1.042.015.286.16
26	d.3	75.4	Rp 1,991,941,513.50	75.4	Rp 1,991,941,513.50
27	d.4	34.1	Rp 108,621,701.63	28.5	Rp 112,776,887.35
28	d.5	52.1	Rp 406.036.297.04	52.1	Rp 406.036.297.04
29	d.6	52.1	Rp 1,101,745,754.39	52.1	Rp 1,101,745,754.39

30	d.7	37.3	Rp	128,561,346.56	31.1	Rp	133.099.017.99
31	e.1	45.4	Rp	1,161,381,099.39	45.4	Rp	1,161,381,099.39
32	e.2	45.4	Rp	1.042.015.286.16	45.4	Rp	1.042.015.286.16
33	e.3	75.4	Rp	1,991,941,513.50	75.4	Rp	1,991,941,513.50
34	e.4	34.1	Rp	108,621,701.63	28.5	Rp	112,776,887.35
35	e.5	52.1	Rp	405,951,248.23	52.1	Rp	405,951,248.23
36	e.6	52.1	Rp	1,101,745,754.39	52.1	Rp	1,101,745,754.39
37	e.7	37.3	Rp	128,561,346.56	31.1	Rp	133.099.017.99
38	f.1	45.4	Rp	1,161,381,099.39	45.4	Rp	1,161,381,099.39
39	f.2	45.4	Rp	1.042.015.286.16	45.4	Rp	1.042.015.286.16
40	f.3	52.1	Rp	1,991,941,513.50	52.1	Rp	1,991,941,513.50
41	f.4	37.3	Rp	108,621,701.63	31.1	Rp	113.159.373.06
42	g.1	26.7	Rp	6,586,790.66	26.7	Rp	6,586,790.66
43	g.2	59.6	Rp	168,044,021.53	49.6	Rp	175,293,864.39
44	h.1	14.7	Rp	5,124,536.20	12.3	Rp	6,915,264.77
45	h.2	40.1	Rp	15,500,149.62	33.5	Rp	20,385,535.34
46	h.3	41.6	Rp	416,139,045.58	34.6	Rp	421,198,288,44
47	i.1	53.6	Rp	1,275,360,201.31	53.6	Rp	1,275,360,201.31
48	i.2	51.3	Rp	845,961,580,36	51.3	Rp	845,961,580,36
49	i.3	51.3	Rp	851,418,162.76	51.3	Rp	851,418,162.76
50	i.4	47.7	Rp	221.3323.620.12	39.8	Rp	227,130,448,69
51	j.1	98.6	Rp	272,611,940.00	98.6	Rp	272,611,940.00
52	j.2	76.0	Rp	19,310,955,80	76.0	Rp	19 ,310,955, 80
53	j.3	76.7	Rp	485,507,688,70	76.7	Rp	485,507,688,70
54	j.4	97.3	Rp	1,225,927,068.10	97.3	Rp	1,225,927,068.10
55	j.5	107.7	Rp	131.564.716.00	107.7	Rp	131.564.716.00
56	j.6	97.7	Rp	4,907,800,000	97.7	Rp	4,907,800,000
57	j.7	100.4	Rp	113,304,160.00	100.4	Rp	113,304,160.00
58	j.8	102.6	Rp	375,963,386.00	102.6	Rp	375,963,386.00
59	j.9	85.0	Rp	224,736,600,000	85.0	Rp	224,736,600,000
60	j.10	76.0	Rp	26,847,000.00	76.0	Rp	26,847,000.00
61	j.11	73.1	Rp	73.803.840.00	73.1	Rp	73.803.840.00
62	j.12	76.1	Rp	62,450.000,00	76.1	Rp	62 ,450.000, 00
63	j.13	47.6	Rp	158,553,100,00	47.6	Rp	158,553,100,00
64	j.14	47.6	Rp	434,000,000.00	39.6	Rp	439,789,442.86
65	j.15	49.3	Rp	144,955,000.00	49.3	Rp	144,955,000.00
66	j.16	47.7	Rp	183.550.000.000,00	47.7	Rp	183.550.000.000,00
67	j.17	47.0	Rp	45,342,500.00	47.0	Rp	45,342,500.00
68	j.18	47.7	Rp	217,846.590.00	47.7	Rp	217,846.590.00
69	j.19	40.1	Rp	106,644,290.00	40.1	Rp	106,644,290.00
70	j.20	39.7	Rp	89,323,600,000	39.7	Rp	89,323,600,000
71	j.21	42.3	Rp	817,265,000.00	35.2	Rp	822,411,171.43
TOTAL	Rp	49,139,000,850,26	TOTAL	Rp	49,227,563,678.83		

Thus, the addition of workers in the construction of the Airlangga University Surabaya parking building project can speed up work, especially in the critical path which has no time to delay in its accelerated work. The following is the total cost of all costs that must be incurred by the project, namely from the normal value of Rp. 49,139,000,850.26 to Rp. 49,227,563,678.83. From the duration of the project calculation, the possible length of work is 340 days with a probability of 99.85% , the rest is 40 days later than the 300 day work duration contract. can be accelerated with the addition of handyman labor as calculated above.

4. Conclusions and recommendations

4.1. Conclusion

Based on the writing that has been done in the construction project of the Parakeet Building, Universitas Airlangga Surabaya, it is concluded as follows:

1. By using the PERT method, the Airlangga University Surabaya Parking Building construction project can be completed the fastest in 260 days with a probability of 0.15%, at the latest it can be completed in 340 days with a probability of 99.85%, and the most likely to be completed in 300 days with probability probability 50%

2. By ensuring that the acceleration is carried out with a time duration of 340 days with a probability of 99.85%, so that activities on the critical path can be carried out by adding labor which is obtained at a normal cost of Rp. 49,139,000,850,26 while the costs incurred by the project after the addition of a handyman or time acceleration with a total cost of Rp 49,227,563,678.83 after being accelerated.

4.2. Suggestion

For further research, it is necessary to calculate the inhibiting factors and other accelerations to get a more optimal time in it in order to reduce the inhibiting factors in its implementation.

Reference

Ahyari, A. (1987). Pengendalian produksi. Badan Penerbit Fakultas Ekonomi Universitas Gadjah Mada.

Badri, S. (1997). Dasar-Dasar Network Planning. Rineka Cipta.

Christian, Cefiro, & L, S. (2013). Studi Kasus Penerapan Metode Pert Pada Proyek Gudang X. Jurnal Dimensi Pratama Teknik Sipil, 2(2).

Efendi, E., & Sahid, N. (2014). Pengendalian Waktu Dan Biaya Menggunakan Metode Pert Pada Proyek Pltu Tanjung Jati B Unit 3 Dan 4 Kabupaten Jepara. Universitas Muhammadiyah Surakarta.

Endah Suwarni, P. (2019). Optimalisasi Waktu Dan Biaya Proyek Dengan Metode Cpm Dan Pert Di Proyek Abc Condotel. Industrika: Jurnal Ilmiah Teknik Industri, 3(1). https://doi.org/10.37090/indstrk.v3i1.125

Heizer, J., & Render, B. (2011). Operations Management: Manajemen Operasi. Salemba Empat.

Kurniasari, F., & Solikin, M. (2016). Evaluasi Pengendalian Waktu Dan Biaya Menggunakan Metode Pert(Studi Kasus: Proyek Pembangunan Gedung Ruang Kuliah Iain Pontianak). Universitas Muhammadiyah Surakarta.

Levin, R. I., & Kirkpatrick, C. A. (1966). Planning and Control with PERT/CPM. McGraw-Hill.

Messah, Y. A., Widodo, T., & Adoe, M. L. (2013). Kajian Penyebab Keterlambatan Pelaksanaan Proyek Konstuksi Gedung Di Kota Kupang. Jurnal Teknik Sipil, 2(2). https://doi.org/https://doi.org/10.35508/jts.2.2.157-168

Oka, J., & Kartikasari, D. (2019). Evaluasi Manajemen Waktu Proyek Menggunakan Metode Pert Dan Cpm Pada Pengerjaan "Proyek Reparasi Crane Lampson" Di Pt Mcdermott Indonesia. Journal Of Applied Business Administration, 1(1), 28–36. https://doi.org/10.30871/jaba.v1i1.1257

Oktrima, B. (2018). Evaluasi Waktu Penyelesaian Proyek dengan Metode PERT (Project Evaluation and Review Technique) di PT.ConcoPhillips Indonesia (Suban Tie In,April 1-2,2006). Jurnal Saintika Unpam : Jurnal Sains Dan Matematika Unpam, 1(1), 98. https://doi.org/10.32493/jsmu.v1i1.1606

Setyawan, P. A., Wardani, A. A. A. C., & Putra, C. (2020). Evaluasi Faktor Penyebab Terjadinya Contract Change Order (Cco) Pada Proyek The Hava Villa. Widya Teknik, 13(1). https://doi.org/https://doi.org/10.32795/widyateknik.v13i01.2051

Situmorang, P. D. S. (2017). Analisa Penjadwalan Proyek Dengan Time Schedule Kurva S, Precedence Diagram Method (Pdm), Dan Ranked Positional Weight Method (RPWM) (Studi Kasus: Proyek Pembangunan Museum Deli Serdang - Lubuk Pakam). Jurnal Teknik Sipil USU, 6(1).

Susila, H., & Handoyono, S. (2016). Analisis Faktor Dominan Resiko Biaya Pada Pelaksanaan Proyek Konstruksi Gedung Di Surakarta. Jurnal Teknik Sipil Dan Arsitektur, 18(22).

Wijaya, F. S., & Sulistio, H. (2019). Penerapan Metode Monte Carlo Pada Penjadwalan Proyek Serpong Garden Apartment. JMTS: Jurnal Mitra Teknik Sipil, 2(3), 189. https://doi.org/10.24912/jmts.v2i3.5828