International Journal Science and Technology

IJST Vol 2 No. 3 | November 2023 | ISSN: 2829-0437 (print), ISSN: 2829-050X (online), Page 84-91

SCHEDULING ANALYSIS IN CONSTRUCTION WITH THE PERT METHOD USING MICROSOFT PROJECT

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Article History
Received : November 2023
Revised : November 2023
Accepted : November 2023
Published : November 2023

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Cite This Article:
B. A. Prasetyo, Haris Muhammadun, and Laksono Djoko Nugroho, "SCHEDULING ANALYSIS IN CONSTRUCTION WITH THE PERT METHOD USING MICROSOFT PROJECT", IJST, vol. 2, no. 3, pp. 84–91, Nov. 2023.

DOI:
https://doi.org/10.56127/ijst.v2i3.1099

Abstract: Since 2017, the Drinking Water Supply System (SPAM) of the Capital District (IKK) Ibu has not been functioning due to damage to the pipe network due to road widening work, damage to generators and pumps, thus PDAM West Halmahera will build a new SPAM network system with a gravity system and will analyze scheduling using the Program Evaluation and Review Technique (PERT) method using Microsoft Project 2021 to carry out development planning which has results where the time required for construction is 320 days and can be completed with a percentage level of 95.35%, with a critical path found in the implementation work occupational health and safety, preparation, piping work, procurement and installation of house connections and commissioning test work with a time of 273 days.

Keywords: Critical Path, Microsoft Project, PERT Method.

INTRODUCTION

Drinking Water Supply System (SPAM) is a unit of facilities and infrastructure for providing drinking water consisting of raw water units, production units, distribution units and service units with a pumping system that includes pump equipment and related equipment to supply raw water and a gravity system. those who do not use pumps only rely on existing gravity to distribute raw water [1], Since 2017 the Drinking Water Supply System (SPAM) of the Capital District (IKK) Ibu has not been functioning due to damage to the pipe network due to road widening work, damage to generators and pumps, and will then be built with a gravity system using water sources from Naga Village.

When building a construction project, you must have good time management and scheduling, where project time management is the stage of identifying a process that is carried out during the course of the project which is related to ensuring that the project can run according to the time, planned technical specifications taking into account cost efficiency but quality. good [2]. After the identification stage is complete and information and data are obtained, the scheduling process continues, thus there will be results or output in the form of a complete report format with time progress indicators [3] namely:

1. Barchart
   A bar chart is a very simple bar chart that will show information on the planned work schedule for a project along with the length of time used for the work.
2. Network Planning
   Network planning is a work network item that identifies critical work that must receive supervision in carrying out the work process because this critical work can cause the length of work on the project to be slower or faster than planned.

In this research the author will analyze the scheduling plan for the construction of the SPAM IKK Ibu West Halmahera Regency project using the PERT method using Microsoft Project 2021, building a new SPAM network system with a gravity network system that uses water sources from Naga Village as an indicator for consideration in planning work so that it can on time and quality, with the problem formulation in this research being as follows:

1. How much time is needed to build the SPAM IKK Ibu West Hamlahera Regency project using the PERT method using Microsoft Project 2021?
2. What work is the critical path in the development of the IKK Ibu SPAM project, West Hamlahera Regency?
3. What is the percentage of work success in the construction of the IKK Ibu SPAM project, West Hamlahera Regency?

The aims of this research are as follows:

1. To find out the length of time for the construction of the SPAM IKK Ibu West Hamlahera Regency project using the PERT method using Microsoft Project 2021;
2. To find out work activities that require the longest time to carry out;
3. To find out the percentage of work success in the construction of the IKK Ibu SPAM project, West Hamlahera Regency.

Previous Research

In the first reference according to [4] with research on Scheduling Analysis and Resource Allocation in Construction Projects Using Microsoft Project with the results obtained, the work that is the critical path is pile work, soldier pile, excavation work, excavation fireplaces, brick installation, work floor construction. , pile cap work and upper structure work and additional resources which will have an impact on increasing work productivity.

In the second reference according to [5] research on Scheduling Analysis Using the Microsoft Project 2010 Application (Case Study: Green Open Space in Wajo Regency) with the results that there were 54 critical paths and 62 non-critical paths in Green Open Space work with a completion time of 120 days.

In the third reference, according to [6] with research on the analysis of the scheduling of work on the Drainage Channel for the Southern Cross Road, Lot. working days are faster than the planner's time and calculating project work time using Microsoft Project for excavation and mortar work, which is critical work, but using the Program Evaluation and Review Technique (PERT) method, the work is slow.

In the fourth reference, research using the PERT-CPM method and its use in project implementation time and cost management resulted in calculating the duration of time to be used using the Program Evaluation and Review Technique (PERT) method of 8 weeks or 49 working days with a chance of completion of 99.38% and using the Critical Path Method (CPM) requires a completion time of 37 days, according to Wiji Yuwono. [7]

RESEARCH METHOD

Location and time of research

The location of this research is Ibu District, West Halmahera Regency, North Maluku Province, which was carried out from September 2023 to December 2023.

PERT Method

The PERT method is a method of scheduling a project based on a network that requires 3 time estimates for each activity, including: optimistic, pessimistic and most likely using these 3 time estimates, carried out from the start of the project to the end of the project using the standards used, the PERT method is used for evaluating work in a project which aims to reduce delays, conflicts and disruptions in a project, including coordinating and synchronizing the completion of project work, this method schedules and budgets a work from the start of the work so that this method makes activities to be effective and controlled [8]. When scheduling using the PERT method, the steps that must be taken into account include:

1. Determine the project to be worked on and prepare a work breakdown structure;
2. Connect activities with each other so that activities can be planned which will be carried out first in sequence from the beginning to the end of the project;
4. Describe the entire network of work that is interconnected from the beginning to the end of the project;
5. Calculate the longest path in the work on the project which is the critical path in the project;
6. Use linkages between work networks to assist project planning, scheduling and control.

To calculate the estimated time using the PERT method with the following formula:

$$TE = \frac{a+4.m+b}{6} \tag{1}$$

Description:
TE = Expected duration
a = Optimistic time
m = Realistic time
b = Pessimistic time

In calculating standard deviation, you can use the following formula:

$$S = \frac{1}{6}(b - a) \quad (2)$$

Where:
S = Activity standard deviation

$$V_{(te)} = S^2 = \frac{1}{6}(b - a) \quad (3)$$

Where:
V(te) = Activity variance

After calculating the total critical activity time (TE) and activity standard deviation (S), the next step is to connect (TE) and (S) to see whether the planned schedule is likely to be in accordance with the target using the following formula:

$$Z = \frac{T(d) - TE}{S} \quad (4)$$

Where:
Z = The probability number of reaching the target
T(d) = Target time

Microsoft Project

Microsoft Project is a software product created for project management developed by the Microsoft company. Microsoft Project is designed to assist work processes in scheduling, determining human and material resources, viewing work progress, controlling and managing budgets and analyzing weights or burdens. on existing work [9], so that Microsoft Project can be a tool for creating good reporting and controlled planning. The things that must be considered when managing a project using Microsoft Project are as follows:

1. Setting Goals
   Setting a goal is the main thing in scheduling because a goal is the direction a project work will be directed so that it can determine the completion time of the work and have a predetermined goal by carrying out focused work which can lead to efficiency in the length of time the work is completed;
2. Set priorities
   Prioritizing is a process or action to organize work by prioritizing work that is interconnected or urgent to be done first to avoid time delays, but work on this work must be in accordance with the normal work sequence, in accordance with technical specifications and work methods;
3. Avoid Procrastination
   When scheduling, it is best to avoid postponing work because postponing work can disrupt the work cycle and result in delays in achieving work goals;
4. Minimize Wasted Time
   Avoid work that can take a long time but provides maximum impact or benefits from the work.

Probability

The three numerical estimates in scheduling are to create a longer time span for planning estimates, because probability theory measures uncertainty and explains it quantitatively so that the possibility of achieving the scheduling target is known [10].

RESULT AND DISCUSSION

Scheduling Using the PERT Method

Table 1. Expected Duration

No	Job Name	Pessimistic (In Days)	Optimistic (In Days)	Realistic (In Days)	TE
1	Implementation Of Occupational Health And Safety (K3)	Follow the longest time of work			
2	Preparatory Work	12	7	10	10
3	Piping Work				
4	Procurement Of Pipelines And Accessories	54	41	48	48
5	Installation Of Hdpe Transmission Pipe Ø200 Mm = 7,700 M	88	73	80	80
6	Installation Of Distribution Pipe Ø200 Mm = 2,000 M	21	17	19	19
7	Installation Of Distribution Pipe Ø160 Mm = 950 M	13	9	11	11
8	Installation Of Distribution Pipe Ø110 Mm = 3,693 M	45	36	40	40
9	Installation Of Distribution Pipe 90 Mm = 6,537 M	64	52	58	58
10	Pipe Bridge Work Dia. 200 Mm (L. 10 M)				
11	Job Abutment Work	31	26	28	28
12	Bridge Steel Structural Work	15	10	12	12
13	Pipe Bridge Work Dia. 110 Mm (W. 20 M)				
14	Job Abutment Work	31	26	28	28
15	Bridge Steel Structural Work	15	10	12	12
16	Existing Reservoir Repair Work	20	15	17	17
17	Caps Steel Sandblasting Reservoir Work. 200 M3				
18	Procurement Of Reservoir Steel Plate Material	34	28	31	31
19	Reservoir Foundation Work	34	28	31	31
20	Reservoir Wall Work	33	26	29	29
21	Mechanical Electrical Work				
22	Procurement Of Mechanical Electrical Materials	69	51	60	60
23	Installation Of Mechanical Electrical Materials	14	10	12	12
24	Disinfectant Building Work	55	43	49	49
25	Procurement And Installation Of House Connections (Sr) 700 Units	43	32	37	37
26	Commissioning Test	7	7	7	7

Source: Author's Processing (2023)

Table 2. Time Deviation

No	Job Name	Pessimistic (In Days)	Optimistic (In Days)	Realistic (In Days)	S
1	Implementation Of Occupational Health And Safety (K3)	Follow the longest time of work			
2	Preparatory Work	12	7	10	1
3	Piping Work				
4	Procurement Of Pipelines And Accessories	54	41	48	2
5	Installation Of Hdpe Transmission Pipe Ø200 Mm = 7,700 M	88	73	80	3
6	Installation Of Distribution Pipe Ø200 Mm = 2,000 M	21	17	19	1
7	Installation Of Distribution Pipe Ø160 Mm = 950 M	13	9	11	1
8	Installation Of Distribution Pipe Ø110 Mm = 3,693 M	45	36	40	2
9	Installation Of Distribution Pipe 90 Mm = 6,537 M	64	52	58	2
10	Pipe Bridge Work Dia. 200 Mm (L. 10 M)				
11	Job Abutment Work	31	26	28	1
12	Bridge Steel Structural Work	15	10	12	1
13	Pipe Bridge Work Dia. 110 Mm (W. 20 M)				
14	Job Abutment Work	31	26	28	1
15	Bridge Steel Structural Work	15	10	12	1
16	Existing Reservoir Repair Work	20	15	17	1
17	Caps Steel Sandblasting Reservoir Work. 200 M3				

No	Job Name	Pessimistic (In Days)	Optimistic (In Days)	Realistic (In Days)	S
18	Procurement Of Reservoir Steel Plate Material	34	28	31	1
19	Reservoir Foundation Work	34	28	31	1
20	Reservoir Wall Work	33	26	29	1
21	Mechanical Electrical Work				
22	Procurement Of Mechanical Electrical Materials	69	51	60	3
23	Installation Of Mechanical Electrical Materials	14	10	12	1
24	Disinfectant Building Work	55	43	49	2
25	Procurement And Installation Of House Connections (Sr) 700 Units	43	32	37	2
26	Commissioning Test	7	7	7	0

Source: Author's Processing (2023)

Table 3. Gravity System Variance

No	Job Name	Pessimistic (In Days)	Optimistic (In Days)	Realistic (In Days)	V
1	Implementation Of Occupational Health And Safety (K3)	Mengikuti waktu terpanjang pekerjaan			
2	Preparatory Work	12	7	10	1
3	Piping Work				
4	Procurement Of Pipelines And Accessories	54	41	48	4
5	Installation Of Hdpe Transmission Pipe Ø200 Mm = 7,700 M	88	73	80	9
6	Installation Of Distribution Pipe Ø200 Mm = 2,000 M	21	17	19	1
7	Installation Of Distribution Pipe Ø160 Mm = 950 M	13	9	11	1
8	Installation Of Distribution Pipe Ø110 Mm = 3,693 M	45	36	40	4
9	Installation Of Distribution Pipe 90 Mm = 6,537 M	64	52	58	4
10	Pipe Bridge Work Dia. 200 Mm (L. 10 M)				
11	Job Abutment Work	31	26	28	1
12	Bridge Steel Structural Work	15	10	12	1
13	Pipe Bridge Work Dia. 110 Mm (W. 20 M)				
14	Job Abutment Work	31	26	28	1
15	Bridge Steel Structural Work	15	10	12	1
16	Existing Reservoir Repair Work	20	15	17	1
17	Caps Steel Sandblasting Reservoir Work. 200 M3				
18	Procurement Of Reservoir Steel Plate Material	34	28	31	1
19	Reservoir Foundation Work	34	28	31	1
20	Reservoir Wall Work	33	26	29	1
21	Mechanical Electrical Work				
22	Procurement Of Mechanical Electrical Materials	69	51	60	9
23	Installation Of Mechanical Electrical Materials	14	10	12	1
24	Disinfectant Building Work	55	43	49	4
25	Procurement And Installation Of House Connections (Sr) 700 Units	43	32	37	4
26	Commissioning Test	7	7	7	0

Scheduling with Microsoft Project

Table 4. Predesors

No	Job Name	Pessimistic (In Days)	Optimistic (In Days)	Realistic (In Days)	Predecessor
1	Implementation Of Occupational Health And Safety (K3)	Follow the longest time of work			
2	Preparatory Work	12	7	10	
3	Piping Work				
4	Procurement Of Pipelines And Accessories	54	41	48	2 FS
5	Installation Of Hdpe Transmission Pipe Ø200 Mm = 7,700M	88	73	80	4 FS

No	Job Name	Pessimistic (In Days)	Optimistic (In Days)	Realistic (In Days)	Predecessor
6	Installation Of Distribution Pipe Ø200 Mm = 2,000 M	21	17	19	5 FS
7	Installation Of Distribution Pipe Ø160 Mm = 950 M	13	9	11	6 FS
8	Installation Of Distribution Pipe Ø110 Mm = 3,693 M	45	36	40	7 FS
9	Installation Of Distribution Pipe 90 Mm = 6,537 M	64	52	58	8 FS
10	Pipe Bridge Work Dia. 200 Mm (L. 10 M)				
11	Job Abutment Job	31	26	28	2 FS
12	Bridge Steel Structural Work	15	10	12	11 FS
13	Pipe Bridge Work Dia. 110 Mm (W. 20 M)				
14	Job Abutment Work	31	26	28	12 FS
15	Bridge Steel Structural Work	15	10	12	14 FS
16	Existing Reservoir Repair Work	20	15	17	2 FS
17	Caps Steel Sandblasting Reservoir Work. 200 M3				
18	Procurement Of Reservoir Steel Plate Material	34	28	31	2 FS
19	Reservoir Foundation Work	34	28	31	18 FS
20	Reservoir Wall Work	33	26	29	19 FS
21	Mechanical Electrical Work				
22	Procurement Of Mechanical Electrical Materials	69	51	60	2 FS
23	Installation Of Mechanical Electrical Materials	14	10	12	22 FS
24	Disinfectant Building Work	55	43	49	16 FS
25	Procurement And Installation Of House Connections (Sr) 700 Units	43	32	37	9 FF
26	Commissioning Test	7	7	7	25 FS

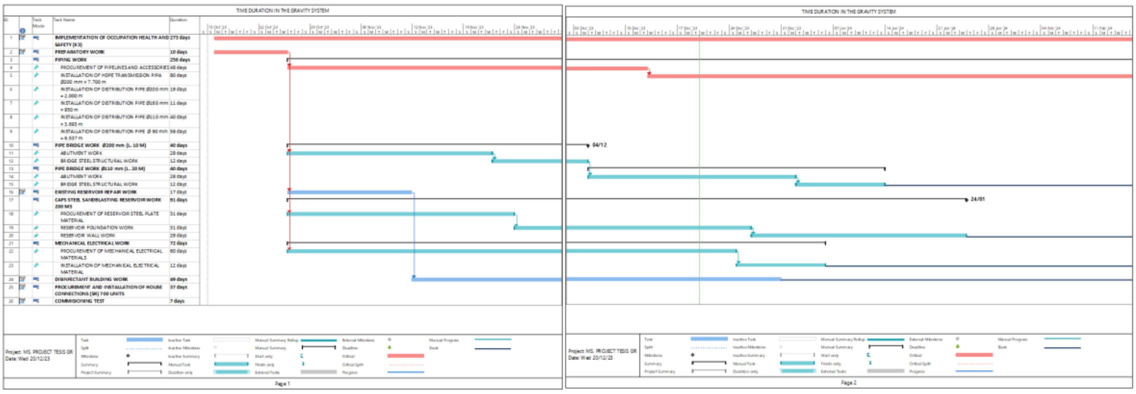

Figure 1. Time Duration in Gravity Systems

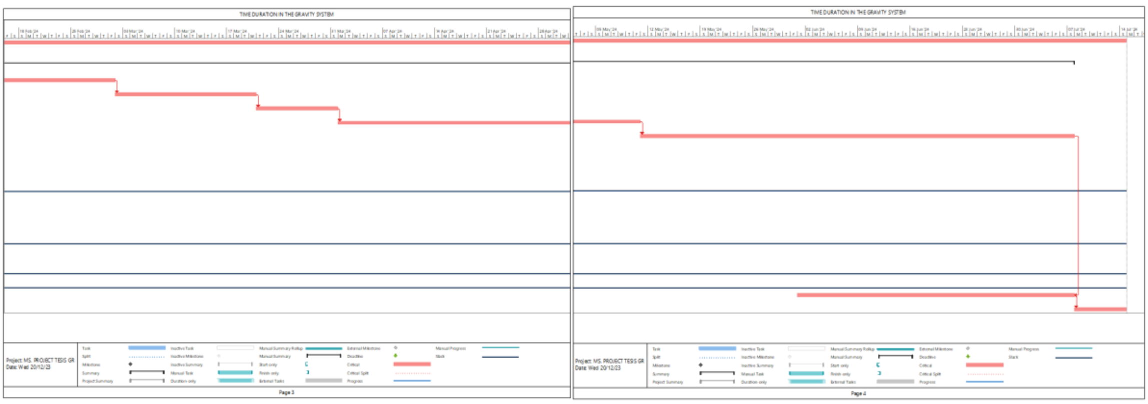

Figure 2. Time Duration in Gravity Systems (Continued)

Analyze the results

The results of the work schedule analysis using Microsoft Project 2021 show that the critical path is in work on implementing occupational health and safety, preparation, piping work, work on procurement and installation of house connections and commissioning test work with a duration of 273 days with a target project plan of 320 days, so Next, the probability will be determined using the following calculations:

$$Z = \frac{T(d) - TE}{S}$$

$$Z = \frac{320 - 273}{28}$$

Z = 1,68

Z = 0,9535 (Seen in Table Z Normal Distribution)Z = 95,35 %

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998

Figure 1. Z Distribution Table

CONCLUSION

1. The time required to construct the SPAM IKK Ibu West Hamlahera Regency project using the PERT method using Microsoft Project 2021 is 320 days;
2. It is known that the critical path is in work implementing occupational health and safety, preparation, piping work, work on procurement and installation of house connections and commissioning test work with a duration of 273 days;
3. By calculating the duration of achieving the target, the construction work for the SPAM IKK Ibu West Hamlahera Regency project can be completed with a percentage level of 95.35%.

REFERENCES

[1] Romli Stefry. (2022). *Pemodelan Risiko Terhadap Pelaku Pekerjaan KonstruksiSistem Penyediaan Air Minum (SPAM) Di Kabupaten Minahasa Selatan*. *12*(1), 1–14.

[2] Yudha Andika Pratama. (2020). *Analisis Penjadwalan Proyek Dengan Metode PERT*. Universitas Islam Indonesia.

[3] Sri Kiswati dan Ummi Chasanah. (2019). Analisis Konsultan Manajemen Konstruksi Terhadap Penerapan Manajemen Waktu Pada Pembangunan Rumah Sakit Di Jawa Tengah. *Neo Teknika*, *5*(1), 1–7.

[4] Danang Isnubroto, (2021). Analisis Penjadwalan Dan Alokasi Sumber Daya Pada Proyek Konstruksi Menggunakan Microsoft Project (Studi Kasus Pekerjaan Struktur Proyek XYZ). Wahana Teknik Sipil. 26(6), 1-14.

[5] Achamd Siddiq, (2022). Analisis Penjadwalan Menggunakan Aplikasi Microsoft Project 2010 (Studi Kaus: Ruang Terbuka Hijau Kabupaten Wajo). 2(1), 1-12

[6] Teranau, T. (2023). Analisis Penjadwalan Pekerjaan Saluran Drainase Jalan Lintas Selatan Lot.6 Kabupaten Tulungagung Dengan Metode PERT. *Ilmiah Teknik Dan Manajemen Industri*, *3*(1), 1–14.

[7] Wiji Yuwono. (2021). Kajian Metode PERT-CPM dan Pemanfaatannya dalam Manajemen Waktu dan Biaya Pelaksanaan Proyek. *JEMATech*, *4*(2), 1–23.

[8] Abdurrasyid. (2019). Implementasi Metode PERT dan CPM pada Sitem Informasi Manajemen Proyek Pembangunan Kapal. *Ilmu Komputer Dan Informatika*, *5*(1), 1–9.

[9] Wahyudin Febriana. (2021). Analisis Penjadwalan Proyek Dengan Metode PERT Menggunakan Microsoft Project 2016. Jurnal Ilmu Teknik Sipil Surya Beton. 5(3), 1-9.

[10] Soeharto, I.1995. Manajemen Proyek dari Konseptual sampai Operasional. Erlangga: Jakarat.