JUIT Jurnal Ilmiah Teknik

JUIT Vol 4 No. 3 | September 18, 2025 | ISSN: 2828-6936 (Print), ISSN: 2828-6901 (online), Page 46-61

Analysis of the Quality, Time, and Cost Planning of the Space Frame Steel Roof Structure in the Indonesia Arena GBK Stadium Project in Jakarta

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Article History

Received : September 07, 2025
Revised : September 18, 2025
Accepted : September 18, 2025
Published : September 18, 2025

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Cite This Article:
Muhamad Kamil, & Alizar, A. (2025). Analysis of the Quality, Time, and Cost Planning of the Space Frame Steel Roof Structure in the Indonesia Arena GBK Stadium Project in Jakarta. Jurnal Ilmiah Teknik, 4(3), 46–61.

DOI:
https://doi.org/10.56127/juit.v4i3.2284

Abstract: The Indonesia Arena GBK Stadium in Jakarta is the first international-standard indoor stadium in Indonesia with a capacity of approximately 16,000 spectators and a roof span of 130 × 103 m. This study analyzes the quality, cost, and installation time of the space frame roof structure and provides optimization recommendations for similar projects. The results show that quality is maintained through systematic work methods, effective zoning, and continuous quality control. The implementation cost was recorded at IDR 57.57 billion with a duration of 105 days for 27 zones. Optimization is recommended through digital inspection, on-ground module prefabrication, parallel work between zones, and integrated material procurement. Space frame technology has been proven to increase installation efficiency and minimize delays, so that the project is completed on time for the 2023 FIBA World Cup.

Keywords: Space frame, quality of implementation, construction costs, implementation time, Indonesia Arena.

INTRODUCTION

Indonesia Arena Stadium, located in the Gelora Bung Karno (GBK) complex in Jakarta, is Indonesia's first international-standard indoor stadium, completed in 2023. With a capacity of approximately 16,000 spectators, the stadium is designed as a multi-functional facility capable of hosting various sports such as basketball, volleyball, and badminton, as well as non-sporting activities. The oval-shaped building design with a roof span measuring 130 meters x 103 meters requires a structural system capable of ensuring strength, safety, and construction efficiency.

The roof truss system uses a space frame steel construction with ball joints. This method was chosen due to its advantages in erection efficiency, design flexibility, and ability to reduce on-site work risks. The use of a space frame is particularly relevant given the long roof span and the project's limited completion time, which must be completed before the 2023 FIBA World Cup.

The successful implementation of this project depends heavily on integrated quality, time, and cost control. Quality control ensures work meets technical specifications; time control prevents delays; and cost control ensures efficient budget utilization. Based on these considerations, this study was conducted to analyze the quality control, timeframe, and cost of implementing a space frame steel roof truss structure for the Indonesia Arena GBK Stadium Project in Jakarta.

The purpose of this study was to analyze the implementation of quality control, timeframe, and cost during the installation of the space frame roof truss structure and to provide optimization recommendations for similar projects in the future.

RESEARCH METHOD

Research methodology is a systematic study of the approaches, techniques, and procedures used to obtain data and information to achieve research objectives. In this study, the methodology serves as a foundation for analyzing the quality, time, and cost of the space frame roof structure work on the Indonesia Arena GBK Stadium Project in Jakarta, using a structured approach based on factual field data. This research employs a descriptive method with qualitative and quantitative approaches, drawing on actual project data, contract documents, and relevant technical implementation information..

Data Source

Data was collected through literature studies, project documents (RAB, S-curves, working drawings, implementation methods), and actual implementation data in the field.

Data Analysis

The data obtained is systematically analyzed to assess the suitability of the quality plan, implementation time, and costs. The analysis includes an evaluation of the implementation method, implementation time, and implementation costs.

RESULT AND DISCUSSION

A. Project Work Zone Implementation Method

In construction activities, the choice of implementation method plays a crucial role because it directly impacts the quality, timeframe, and cost of the work. The more appropriate the method used, the greater the chance of success in terms of time, cost, and construction quality.

For the GBK Stadium project in Jakarta, the roof structure was designed using a space frame construction system. This system was chosen for its high load-bearing capacity, material efficiency, and design flexibility for wide spans such as those found in stadiums. In this method, the roof structure is assembled using steel pipe elements or members with cones installed at each end. Each member is then connected to the others using ball joints as the meeting points between the elements, forming a unified and stable frame.

1. Project Work Zone

In its implementation, the space frame roof truss is divided into 27 zones. This zoning division aims to simplify construction management in the field, particularly during the erection process of the roof truss structure. With structured zoning, the implementation can be carried out in stages and systematically, thereby minimizing the risk of installation errors and increasing time and labor efficiency. The following is an explanation of the space frame roof truss installation zones applied to the Indonesia Arena Gelora Bung Karno (GBK) Jakarta project :

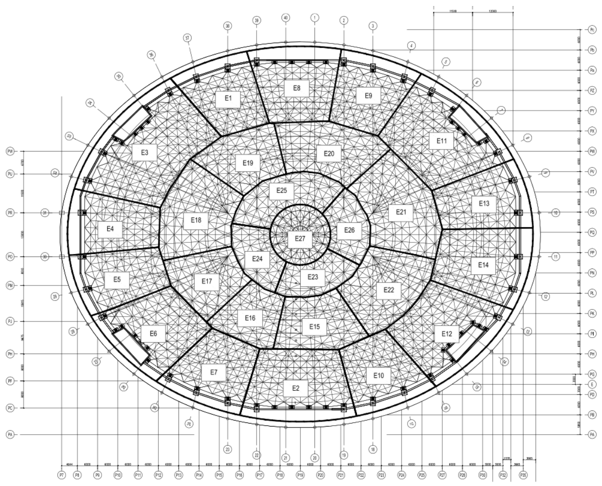


Figure 1. Project Work Zone

2. Preliminary Work

Prior to erection of the space frame roof truss structure, preliminary work was conducted to ensure that technical conditions on site met specifications and achieved high geometric accuracy. These activities included :

a) Measuring and marking support points based on verified shop drawings.
b) Installation of anchors, base plates, and primary mediators to connect the concrete structure to the space frame.
c) Using precision measuring instruments such as a total station, digital water level, and laser level.
d) Installation of temporary footings and tower supports as temporary supports, with adequate load and stability calculations.

Figure 2. Tower Support Installation

3. **Sorting work, module assembly and component painting (Preassembly)**

The preassembly phase is a crucial preparatory process before erection begins in the field. This phase ensures all space frame components are ready for installation, correctly identified, and meet established quality standards. This work includes the following activities:

a) The process begins with sorting components by location and erection blocks according to shop drawings. This step aims to organize the distribution of materials to ensure smooth installation on the site, avoid stacking, and reduce the risk of logistical errors.

Figure 3. Space Frame Material Sorting Process

b) Next, submodule assembly occurs, which involves combining members and ball joints into small modular units in a safely prepared work area. This assembly uses methods that comply with technical standards and is assisted by equipment such as jigs to ensure accurate dimensions and joint positions. The assembled modules can then be lifted directly into their final positions on the main structure without requiring extensive adjustments at height.

Figure 4. Space Frame Module Assembly Process

c) The next stage is the final surface coating of all components, including purlins, to provide maximum protection against corrosion while maintaining the aesthetic appearance as designed. This work is carried out in accordance with technical specifications, including measuring the paint layer thickness (DFT) to ensure the quality of the protection.

Figure 5. Space Frame Module Painting Process

d) The entire preassembly process is accompanied by regular Quality Control (QC). Inspections include checking member dimensions, joint positions and angles, and paint thickness. Each inspection result is documented in a QC report, and only components that meet the criteria can proceed to the erection stage.

Figure 6. Quality Control Check

4. Assembling - Erection Work

a) Assembly Area Preparation

This stage begins with selecting an assembly site on the ground close to the erection zone. Site selection takes into account crane access for lifting blocks, adequate work area for mobilizing materials and labor, and safety aspects to ensure the process runs smoothly without disrupting surrounding activities.

Figure 7. Space Frame Module Assembly

b) Ground Block Assembly

In the prepared area, the sorted and pre-assembled space frame modules are assembled into large blocks according to the working drawings. This assembly is carried out systematically to ensure each connection is installed in the specified sequence and dimensions. Once the block assembly is complete, a final coat of paint is applied to protect the material from corrosion, and a thorough quality inspection is conducted to ensure all components are ready to be lifted.

Figure 8. Space Frame Module Painting

c) Erection Process

Once the blocks are declared ready, they are lifted to their final position using a mobile crane or tower crane, depending on the size and location of the blocks within the installation zone. Lifting is carried out carefully and in stages to avoid deformation or impact. Once the blocks reach the specified height, temporary support is immediately applied using tower supports to maintain structural stability.

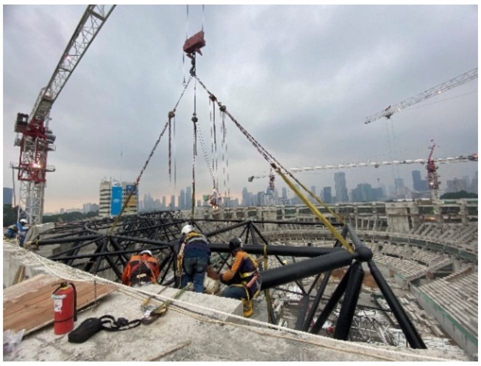


Figure 9. Space Frame Module Erection Process

d) Connection Above the Structure

The installed blocks are then precisely connected to the previous modules. This connection process requires high precision to ensure the positions and angles between components match the design, creating a rigid, stable, and fully integrated roof truss system.

Figure 10. Space Frame Module Merging Process for Each Zone

e) Position and Elevation Check

In the final stage, the technical team checks the position, elevation, and deflection using a total station or digital water level at predetermined control points. These measurements ensure that all structural components are within permitted tolerances, ensuring compliance between field results and technical plans.

5. **Tahap finalisasi**

a) The finalization stage is the final step after the entire erection process of the space frame structure is complete. It aims to ensure that each element is installed according to quality standards and is ready for optimal function. This process begins with tightening all connections including members, ball joints, purlins, and fastening bolts using a torque wrench according to technical specifications. Tightening is carried out systematically and documented to ensure long-term connection strength.

b) Next, the Quality Control team conducts a thorough inspection, including measuring deflections, checking the position of ball joints, and evaluating the stresses between joints. If required, load tests are also conducted to verify the structure's stiffness and stability.

c) Finally, an As-Built Drawing is prepared, depicting the final condition of the structure, including dimensions, position, and changes during construction. This document serves as an important reference for the project owner and future maintenance teams.

Results of Work Volume Calculation

This space frame roof structure is a specialized project, with complex fieldwork. Therefore, the volume of work is calculated using AutoCAD software based on the square footage of the work area, according to the job zoning. The following is the calculation of the space frame volume:

Table 1. Space Frame Volume Calculation Results

No	Description	Area	Volume	Unit
1	Zona - E1	Outer Ring	434,59	m^2
2	Zona - E2	Outer Ring	612,35	m^2
3	Zona - E3	Outer Ring	896,62	m^2
4	Zona - E4	Outer Ring	424,09	m^2
5	Zona - E5	Outer Ring	409,50	m^2
6	Zona - E6	Outer Ring	544,41	m^2
7	Zona - E7	Outer Ring	455,69	m^2
8	Zona - E8	Outer Ring	507,11	m^2
9	Zona - E9	Outer Ring	442,77	m^2
10	Zona - E10	Outer Ring	432,35	m^2
11	Zona - E11	Outer Ring	757,04	m^2
12	Zona - E12	Outer Ring	630,15	m^2
13	Zona - E13	Outer Ring	444,33	m^2
14	Zona - E14	Outer Ring	551,61	m^2
15	Zona - E15	Middle Circle	359,82	m^2

16	Zona - E16	Middle Circle	281,09	m^2
17	Zona - E17	Middle Circle	337,41	m^2
18	Zona - E18	Middle Circle	495,82	m^2
19	Zona - E19	Middle Circle	352,55	m^2
20	Zona - E20	Middle Circle	441,93	m^2
21	Zona - E21	Middle Circle	553,95	m^2
22	Zona - E22	Middle Circle	455,35	m^2
23	Zona - E23	Inner Circle	213,26	m^2
24	Zona - E24	Inner Circle	205,09	m^2
25	Zona - E25	Inner Circle	315,44	m^2
26	Zona - E26	Inner Circle	209,14	m^2
27	Zona - E27	Inner Circle	247,67	m^2
Total			12.011,13	m^2

Source : Author's Processed Data, 2025

B. Results of Calculation of Work Unit Price

The calculation price for the work unit for the space frame system roof structure is made in m2 units, including the price of labor wages, the price of materials and the price of equipment according to the offer from the subcontractor using Microsoft Excel software with the following results :

a) Installation cost for 1 m2 of space frame work includes
- Labor costs
- Member material 3" - 12" (STK 41 / SS 400) (ex. Gunung Garuda)
- Ball joint material T.84 - T.600 (ex. China)
- Base plate + anchors
- Duco paint t : 150 Micron (ex. Jotun)
- Equipment costs

Total unit price per m2 of space frame installation: Rp. 4,027,500.00

b) The installation price for 1 m2 of space frame purlins includes
- Labor costs
- Primary purlin material, 4" (3.5") diameter, plus roll
- Secondary purlin material, 3" (3.2") diameter, plus roll
- Equipment costs

Total unit price per m2 of space frame purlin installation: Rp. 330,000.00

Results of the Cost Budget Plan (RAB) Calculation

The results of the calculation of the Budget Plan for the construction of the Space Frame Roof Structure for the Indonesia Arena GBK Jakarta Gelora Bung Karno Stadium Project are obtained from multiplying the work costs in the unit price analysis multiplied by the work volume for each work zoning area using Microsoft Excel software. The Budget Plan for the construction of the Space Frame Roof Structure for the Indonesia Arena GBK Jakarta Gelora Bung Karno Stadium Project can be seen in the following table:

Table 2. Recapitulation of Space Frame Member and Ball Joint Work

No	Description	Unit	Volume	Unit price	Amount
1	Zona - E1	m^2	434,59	4.027.500,00	1.750.294.257,14
2	Zona - E2	m^2	612,35	4.027.500,00	2.466.256.886,87
3	Zona - E3	m^2	896,62	4.027.500,00	3.611.155.294,58
4	Zona - E4	m^2	424,09	4.027.500,00	1.708.030.493,75
5	Zona - E5	m^2	409,50	4.027.500,00	1.649.276.880,73
6	Zona - E6	m^2	544,41	4.027.500,00	2.192.605.998,98
7	Zona - E7	m^2	455,69	4.027.500,00	1.835.276.343,68
8	Zona - E8	m^2	507,11	4.027.500,00	2.042.401.852,49
9	Zona - E9	m^2	442,77	4.027.500,00	1.783.274.185,98
10	Zona - E10	m^2	432,35	4.027.500,00	1.741.270.635,34
11	Zona - E11	m^2	757,04	4.027.500,00	3.048.974.854,43
12	Zona - E12	m^2	630,15	4.027.500,00	2.537.928.089,93
13	Zona - E13	m^2	444,33	4.027.500,00	1.789.523.867,16
14	Zona - E14	m^2	551,61	4.027.500,00	2.221.620.048,56
15	Zona - E15	m^2	359,82	4.027.500,00	1.449.182.960,01
16	Zona - E16	m^2	281,09	4.027.500,00	1.132.106.757,59
17	Zona - E17	m^2	337,41	4.027.500,00	1.358.914.433,36
18	Zona - E18	m^2	495,82	4.027.500,00	1.996.922.388,11
19	Zona - E19	m^2	352,55	4.027.500,00	1.419.901.548,86
20	Zona - E20	m^2	441,93	4.027.500,00	1.779.861.705,37
21	Zona - E21	m^2	553,95	4.027.500,00	2.231.029.569,31
22	Zona - E22	m^2	455,35	4.027.500,00	1.833.903.473,65
23	Zona - E23	m^2	213,26	4.027.500,00	858.890.424,87
24	Zona - E24	m^2	205,09	4.027.500,00	826.006.221,65
25	Zona - E25	m^2	315,44	4.027.500,00	1.270.447.902,83
26	Zona - E26	m^2	209,14	4.027.500,00	842.296.319,37
27	Zona - E27	m^2	247,67	4.027.500,00	997.473.244,28
Total					48.374.826.638,85

Source : Author's Processed Data, 2025

Table 3. Recapitulation of Primary and Secondary Space Frame Gording Work

No	Description	Unit	Volume	Unit price	Amount
1	Zona - E1	m^2	434,59	330.000,00	143.413.309,71
2	Zona - E2	m^2	612,35	330.000,00	202.076.914,38
3	Zona - E3	m^2	896,62	330.000,00	295.886.094,90
4	Zona - E4	m^2	424,09	330.000,00	139.950.357,03

5	Zona - E5	m^2	409,50	330.000,00	135.136.280,73
6	Zona - E6	m^2	544,41	330.000,00	179.654.867,70
7	Zona - E7	m^2	455,69	330.000,00	150.376.460,19
8	Zona - E8	m^2	507,11	330.000,00	167.347.637,82
9	Zona - E9	m^2	442,77	330.000,00	146.115.575,76
10	Zona - E10	m^2	432,35	330.000,00	142.673.944,05
11	Zona - E11	m^2	757,04	330.000,00	249.822.893,10
12	Zona - E12	m^2	630,15	330.000,00	207.949.415,19
13	Zona - E13	m^2	444,33	330.000,00	146.627.653,92
14	Zona - E14	m^2	551,61	330.000,00	182.032.182,75
15	Zona - E15	m^2	359,82	330.000,00	118.741.248,12
16	Zona - E16	m^2	281,09	330.000,00	92.761.075,11
17	Zona - E17	m^2	337,41	330.000,00	111.344.944,26
18	Zona - E18	m^2	495,82	330.000,00	163.621.201,26
19	Zona - E19	m^2	352,55	330.000,00	116.342.026,35
20	Zona - E20	m^2	441,93	330.000,00	145.835.968,41
21	Zona - E21	m^2	553,95	330.000,00	182.803.167,69
22	Zona - E22	m^2	455,35	330.000,00	150.263.971,77
23	Zona - E23	m^2	213,26	330.000,00	70.374.634,44
24	Zona - E24	m^2	205,09	330.000,00	67.680.211,83
25	Zona - E25	m^2	315,44	330.000,00	104.096.289,99
26	Zona - E26	m^2	209,14	330.000,00	69.014.968,44
27	Zona - E27	m^2	247,67	330.000,00	81.729.651,30
			Total		3.963.672.946,20

Source : Author's Processed Data, 2025

Table 4. Recapitulation of Total Budget Plan for Space Frame Roof Truss Work

No	Description	Unit	Volume	Unit price	Amount
1	Member and Ball Joint Work	m^2	12.011,13	4.027.500,00	48.374.826.638,85
2	Primary and Secondary Purlin Work	m^2	12.011,13	330.000,00	3.963.672.946,20
				Total Cost of Work	52.338.499.585,05
				Ppn 10%	5.233.849.958,51
				Total Cost of the Work	57.572.349.543,56

Source : Author's Processed Data, 2025

C. Results of Implementation Time Calculation

The calculation of the implementation time for the installation of the Space Frame Roof Truss Structure is made into 27 stages according to the division of work zones, where the installation of this roof truss structure is divided into 2 teams, each team consisting of 20 people, consisting of the assembly team, erection team, tower support installation team and heavy equipment operator team. The following is an explanation of the implementation duration for each work zone :

Table 5. Results of the Calculation of the Duration of Implementation

No	Description	Area	Duration of Implementation (Days)		
			Assembling	Erection	Install Tower Support
1	Zona - E1	Outer Ring	6	7	1
2	Zona - E2	Outer Ring	8	9	1
3	Zona - E3	Outer Ring	12	13	1
4	Zona - E4	Outer Ring	6	7	1
5	Zona - E5	Outer Ring	6	7	1
6	Zona - E6	Outer Ring	7	8	1
7	Zona - E7	Outer Ring	6	7	1
8	Zona - E8	Outer Ring	7	8	1
9	Zona - E9	Outer Ring	6	7	1
10	Zona - E10	Outer Ring	6	7	1
11	Zona - E11	Outer Ring	10	11	1
12	Zona - E12	Outer Ring	8	9	1
13	Zona - E13	Outer Ring	6	7	1
14	Zona - E14	Outer Ring	7	8	1
15	Zona - E15	Middle Circle	5	6	1
16	Zona - E16	Middle Circle	4	5	1
17	Zona - E17	Middle Circle	5	5	1
18	Zona - E18	Middle Circle	7	8	1
19	Zona - E19	Middle Circle	5	6	1
20	Zona - E20	Middle Circle	6	7	1
21	Zona - E21	Middle Circle	7	8	1
22	Zona - E22	Middle Circle	6	7	1
23	Zona - E23	Inner Circle	3	4	1
24	Zona - E24	Inner Circle	3	3	1
25	Zona - E25	Inner Circle	4	5	1
26	Zona - E26	Inner Circle	3	3	1
27	Zona - E27	Inner Circle	4	4	1

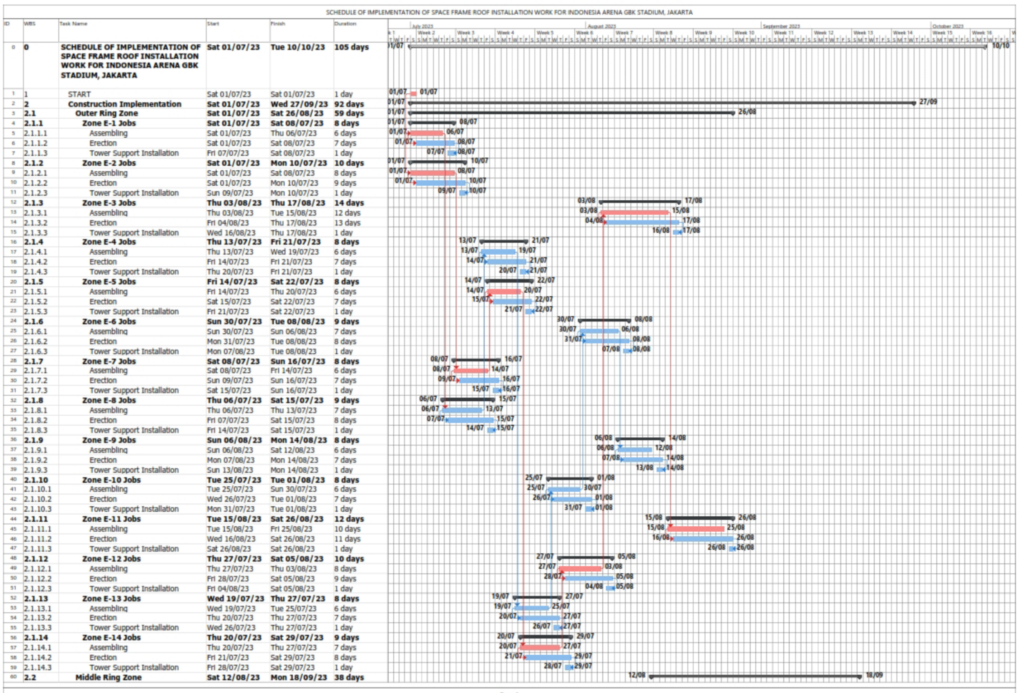
Source : Author's Processed Data, 2025

Finalization Work Duration :

- Tightening all members with ball joints using a torque wrench : 12 Calendar Days
- Inspection of all work items for quality : 12 Calendar Days

From the calculation of the zoning implementation time above, the total implementation time for the installation of the Space Frame Roof Structure is 105 calendar days, according to the calculations that have been carried out using Microsoft Project software and the attached S-curve schedule.

Table 6. The duration of implementation in the outer ring zone is 59 days

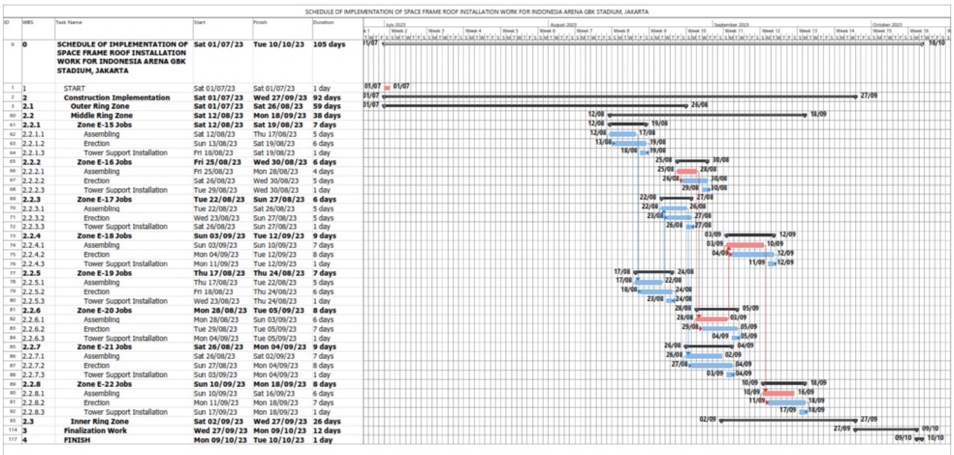


SCHEDULE OF IMPLEMENTATION OF SPACE FRAME ROOF INSTALLATION WORK FOR INDONESIA ARENA GBK STADIUM, JAKARTA

ID	WBS	Task Name	Start	Finish	Duration
0	**0**	**SCHEDULE OF IMPLEMENTATION OF SPACE FRAME ROOF INSTALLATION WORK FOR INDONESIA ARENA GBK STADIUM, JAKARTA**	**Sat 01/07/23**	**Tue 10/10/23**	**105 days**
1	1	START	Sat 01/07/23	Sat 01/07/23	1 day
2	**2**	**Construction Implementation**	**Sat 01/07/23**	**Wed 27/09/23**	**92 days**
3	**2.1**	**Outer Ring Zone**	**Sat 01/07/23**	**Sat 26/08/23**	**59 days**
4	**2.1.1**	**Zone E-1 Jobs**	**Sat 01/07/23**	**Sat 08/07/23**	**8 days**
5	2.1.1.1	Assembling	Sat 01/07/23	Thu 06/07/23	6 days
6	2.1.1.2	Erection	Sat 01/07/23	Sat 08/07/23	7 days
7	2.1.1.3	Tower Support Installation	Fri 07/07/23	Sat 08/07/23	1 day
8	**2.1.2**	**Zone E-2 Jobs**	**Sat 01/07/23**	**Mon 10/07/23**	**10 days**
9	2.1.2.1	Assembling	Sat 01/07/23	Sat 08/07/23	8 days
10	2.1.2.2	Erection	Sat 01/07/23	Mon 10/07/23	9 days
11	2.1.2.3	Tower Support Installation	Sun 09/07/23	Mon 10/07/23	1 day
12	**2.1.3**	**Zone E-3 Jobs**	**Thu 03/08/23**	**Thu 17/08/23**	**14 days**
13	2.1.3.1	Assembling	Thu 03/08/23	Tue 15/08/23	12 days
14	2.1.3.2	Erection	Fri 04/08/23	Thu 17/08/23	13 days
15	2.1.3.3	Tower Support Installation	Wed 16/08/23	Thu 17/08/23	1 day
16	**2.1.4**	**Zone E-4 Jobs**	**Thu 13/07/23**	**Fri 21/07/23**	**8 days**
17	2.1.4.1	Assembling	Thu 13/07/23	Wed 19/07/23	6 days
18	2.1.4.2	Erection	Fri 14/07/23	Fri 21/07/23	7 days
19	2.1.4.3	Tower Support Installation	Thu 20/07/23	Fri 21/07/23	1 day
20	**2.1.5**	**Zone E-5 Jobs**	**Fri 14/07/23**	**Sat 22/07/23**	**8 days**
21	2.1.5.1	Assembling	Fri 14/07/23	Thu 20/07/23	6 days
22	2.1.5.2	Erection	Sat 15/07/23	Sat 22/07/23	7 days
23	2.1.5.3	Tower Support Installation	Fri 21/07/23	Sat 22/07/23	1 day
24	**2.1.6**	**Zone E-6 Jobs**	**Sun 30/07/23**	**Tue 08/08/23**	**9 days**
25	2.1.6.1	Assembling	Sun 30/07/23	Sun 06/08/23	7 days
26	2.1.6.2	Erection	Mon 31/07/23	Tue 08/08/23	8 days
27	2.1.6.3	Tower Support Installation	Mon 07/08/23	Tue 08/08/23	1 day
28	**2.1.7**	**Zone E-7 Jobs**	**Sat 08/07/23**	**Sun 16/07/23**	**8 days**
29	2.1.7.1	Assembling	Sat 08/07/23	Fri 14/07/23	6 days
30	2.1.7.2	Erection	Sun 09/07/23	Sun 16/07/23	7 days
31	2.1.7.3	Tower Support Installation	Sat 15/07/23	Sun 16/07/23	1 day
32	**2.1.8**	**Zone E-8 Jobs**	**Thu 06/07/23**	**Sat 15/07/23**	**9 days**
33	2.1.8.1	Assembling	Thu 06/07/23	Thu 13/07/23	7 days
34	2.1.8.2	Erection	Fri 07/07/23	Sat 15/07/23	8 days
35	2.1.8.3	Tower Support Installation	Fri 14/07/23	Sat 15/07/23	1 day
36	**2.1.9**	**Zone E-9 Jobs**	**Sun 06/08/23**	**Mon 14/08/23**	**8 days**
37	2.1.9.1	Assembling	Sun 06/08/23	Sat 12/08/23	6 days
38	2.1.9.2	Erection	Mon 07/08/23	Mon 14/08/23	7 days
39	2.1.9.3	Tower Support Installation	Sun 13/08/23	Mon 14/08/23	1 day
40	**2.1.10**	**Zone E-10 Jobs**	**Tue 25/07/23**	**Tue 01/08/23**	**8 days**
41	2.1.10.1	Assembling	Tue 25/07/23	Sun 30/07/23	6 days
42	2.1.10.2	Erection	Wed 26/07/23	Tue 01/08/23	7 days
43	2.1.10.3	Tower Support Installation	Mon 31/07/23	Tue 01/08/23	1 day
44	**2.1.11**	**Zone E-11 Jobs**	**Tue 15/08/23**	**Sat 26/08/23**	**12 days**
45	2.1.11.1	Assembling	Tue 15/08/23	Fri 25/08/23	10 days
46	2.1.11.2	Erection	Wed 16/08/23	Sat 26/08/23	11 days
47	2.1.11.3	Tower Support Installation	Sat 26/08/23	Sat 26/08/23	1 day
48	**2.1.12**	**Zone E-12 Jobs**	**Thu 27/07/23**	**Sat 05/08/23**	**10 days**
49	2.1.12.1	Assembling	Thu 27/07/23	Thu 03/08/23	8 days
50	2.1.12.2	Erection	Fri 28/07/23	Sat 05/08/23	9 days
51	2.1.12.3	Tower Support Installation	Fri 04/08/23	Sat 05/08/23	1 day
52	**2.1.13**	**Zone E-13 Jobs**	**Wed 19/07/23**	**Thu 27/07/23**	**8 days**
53	2.1.13.1	Assembling	Wed 19/07/23	Tue 25/07/23	6 days
54	2.1.13.2	Erection	Thu 20/07/23	Thu 27/07/23	7 days
55	2.1.13.3	Tower Support Installation	Wed 26/07/23	Thu 27/07/23	1 day
56	**2.1.14**	**Zone E-14 Jobs**	**Thu 20/07/23**	**Sat 29/07/23**	**9 days**
57	2.1.14.1	Assembling	Thu 20/07/23	Thu 27/07/23	7 days
58	2.1.14.2	Erection	Fri 21/07/23	Sat 29/07/23	8 days
59	2.1.14.3	Tower Support Installation	Fri 28/07/23	Sat 29/07/23	1 day
60	**2.2**	**Middle Ring Zone**	**Sat 12/08/23**	**Mon 18/09/23**	**38 days**

Source : Author's Processed Data, 2025

Table 7. The duration of implementation in the middle ring zone is 38 days

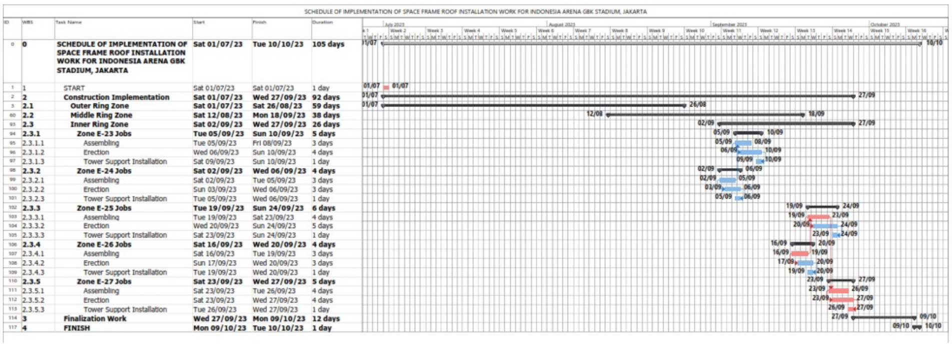


SCHEDULE OF IMPLEMENTATION OF SPACE FRAME ROOF INSTALLATION WORK FOR INDONESIA ARENA GBK STADIUM, JAKARTA

ID	WBS	Task Name	Start	Finish	Duration
0	**0**	**SCHEDULE OF IMPLEMENTATION OF SPACE FRAME ROOF INSTALLATION WORK FOR INDONESIA ARENA GBK STADIUM, JAKARTA**	**Sat 01/07/23**	**Tue 10/10/23**	**105 days**
1	1	START	Sat 01/07/23	Sat 01/07/23	1 day
2	**2**	**Construction Implementation**	**Sat 01/07/23**	**Wed 27/09/23**	**92 days**
3	**2.1**	**Outer Ring Zone**	**Sat 01/07/23**	**Sat 26/08/23**	**59 days**
60	**2.2**	**Middle Ring Zone**	**Sat 12/08/23**	**Mon 18/09/23**	**38 days**
61	**2.2.1**	**Zone E-15 Jobs**	**Sat 12/08/23**	**Sat 19/08/23**	**7 days**
62	2.2.1.1	Assembling	Sat 12/08/23	Thu 17/08/23	5 days
63	2.2.1.2	Erection	Sun 13/08/23	Sat 19/08/23	6 days
64	2.2.1.3	Tower Support Installation	Fri 18/08/23	Sat 19/08/23	1 day
65	**2.2.2**	**Zone E-16 Jobs**	**Fri 25/08/23**	**Wed 30/08/23**	**6 days**
66	2.2.2.1	Assembling	Fri 25/08/23	Mon 28/08/23	4 days
67	2.2.2.2	Erection	Sat 26/08/23	Wed 30/08/23	5 days
68	2.2.2.3	Tower Support Installation	Tue 29/08/23	Wed 30/08/23	1 day
69	**2.2.3**	**Zone E-17 Jobs**	**Tue 22/08/23**	**Sun 27/08/23**	**6 days**
70	2.2.3.1	Assembling	Tue 22/08/23	Sat 26/08/23	5 days
71	2.2.3.2	Erection	Wed 23/08/23	Sun 27/08/23	5 days
72	2.2.3.3	Tower Support Installation	Sat 26/08/23	Sun 27/08/23	1 day
73	**2.2.4**	**Zone E-18 Jobs**	**Sun 03/09/23**	**Tue 12/09/23**	**9 days**
74	2.2.4.1	Assembling	Sun 03/09/23	Sun 10/09/23	7 days
75	2.2.4.2	Erection	Mon 04/09/23	Tue 12/09/23	8 days
76	2.2.4.3	Tower Support Installation	Mon 11/09/23	Tue 12/09/23	1 day
77	**2.2.5**	**Zone E-19 Jobs**	**Thu 17/08/23**	**Thu 24/08/23**	**7 days**
78	2.2.5.1	Assembling	Thu 17/08/23	Tue 22/08/23	5 days
79	2.2.5.2	Erection	Fri 18/08/23	Thu 24/08/23	6 days
80	2.2.5.3	Tower Support Installation	Wed 23/08/23	Thu 24/08/23	1 day
81	**2.2.6**	**Zone E-20 Jobs**	**Mon 28/08/23**	**Tue 05/09/23**	**8 days**
82	2.2.6.1	Assembling	Mon 28/08/23	Sun 03/09/23	6 days
83	2.2.6.2	Erection	Tue 29/08/23	Tue 05/09/23	7 days
84	2.2.6.3	Tower Support Installation	Mon 04/09/23	Tue 05/09/23	1 day
85	**2.2.7**	**Zone E-21 Jobs**	**Sat 26/08/23**	**Mon 04/09/23**	**9 days**
86	2.2.7.1	Assembling	Sat 26/08/23	Sat 02/09/23	7 days
87	2.2.7.2	Erection	Sun 27/08/23	Mon 04/09/23	8 days
88	2.2.7.3	Tower Support Installation	Sun 03/09/23	Mon 04/09/23	1 day
89	**2.2.8**	**Zone E-22 Jobs**	**Sun 10/09/23**	**Mon 18/09/23**	**8 days**
90	2.2.8.1	Assembling	Sun 10/09/23	Sat 16/09/23	6 days
91	2.2.8.2	Erection	Mon 11/09/23	Mon 18/09/23	7 days
92	2.2.8.3	Tower Support Installation	Sun 17/09/23	Mon 18/09/23	1 day
93	**2.3**	**Inner Ring Zone**	**Sat 02/09/23**	**Wed 27/09/23**	**26 days**
114	**3**	**Finalization Work**	**Wed 27/09/23**	**Mon 09/10/23**	**12 days**
117	**4**	**FINISH**	**Mon 09/10/23**	**Tue 10/10/23**	**1 day**

Source : Author's Processed Data, 2025

Table 8. The duration of implementation in this inner ring zone is 26 days



Source : Author's Processed Data, 2025

Table 9. S-Curve Schedule

IMPLEMENTATION PERIOD (S CURVE)
SPACE FRAME ROOF INSTALLATION WORK FOR INDONESIA ARENA GBK STADIUM, JAKARTA

NO	JOB DESCRIPTION	WEIGHT	IMPLEMENTATION PERIOD : 105 (ONE HUNDRED AND FIVE) CALENDAR DAYS															information
			YEAR - 2023															
			M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8	M-9	M-10	M-11	M-12	M-13	M-14	M-15	
			01/07 s/d 07/07	08/07 s/d 14/07	15/07 s/d 21/07	22/07 s/d 28/07	29/07 s/d 04/08	05/08 s/d 11/08	12/08 s/d 18/08	19/08 s/d 25/08	26/08 s/d 01/09	02/09 s/d 08/09	09/09 s/d 15/09	16/09 s/d 22/09	23/09 s/d 29/09	30/09 s/d 06/10	07/10 s/d 10/10	
			MONTH 1				MONTH 2				3RD MONTH				4TH MONTH			
A.	STRUCTURAL WORK																	
A.1	SPACE FRAME ROOF STRUCTURE WORK																	
	A.1.1 ROOF FRAME SPACE FRAME OUTER CIRCLE AREA																	
	A.1.1.1 Zona - E1	3,618	1,009	2,609	-	-	-	-	-	-	-	-	-	-	-	-	-	
	A.1.1.2 Zona - E2	5,098	2,049	3,049	-	-	-	-	-	-	-	-	-	-	-	-	-	
	A.1.1.3 Zona - E3	7,465	-	-	-	-	1,588	4,888	0,988	-	-	-	-	-	-	-	-	
	A.1.1.4 Zona - E4	3,531	-	0,765	2,765	-	-	-	-	-	-	-	-	-	-	-	-	
	A.1.1.5 Zona - E5	3,409	-	-	0,705	2,705	-	-	-	-	-	-	-	-	-	-	-	
	A.1.1.6 Zona - E6	4,533	-	-	-	-	2,266	2,266	-	-	-	-	-	-	-	-	-	
	A.1.1.7 Zona - E7	3,794	-	-	-	-	-	1,897	1,897	-	-	-	-	-	-	-	-	
	A.1.1.8 Zona - E8	4,222	-	1,111	3,111	-	-	-	-	-	-	-	-	-	-	-	-	
	A.1.1.9 Zona - E9	3,686	-	-	-	-	-	1,843	1,843	-	-	-	-	-	-	-	-	
	A.1.1.10 Zona - E10	3,600	-	-	-	0,800	2,800	-	-	-	-	-	-	-	-	-	-	
	A.1.1.11 Zona - E11	6,303	-	-	-	-	-	-	2,651	3,651	-	-	-	-	-	-	-	
	A.1.1.12 Zona - E12	5,246	-	-	-	0,823	4,423	-	-	-	-	-	-	-	-	-	-	
	A.1.1.13 Zona - E13	3,699	-	-	0,850	2,850	-	-	-	-	-	-	-	-	-	-	-	
	A.1.1.14 Zona - E14	4,593	-	-	1,296	3,296	-	-	-	-	-	-	-	-	-	-	-	
	A.1.2 ROOF FRAME SPACE FRAME CENTER CIRCUMFERENCE AREA																	
	A.1.2.1 Zona - E15	2,996	-	-	-	-	-	-	1,198	1,798	-	-	-	-	-	-	-	
	A.1.2.2 Zona - E16	2,340	-	-	-	-	-	-	-	1,170	1,170	-	-	-	-	-	-	
	A.1.2.3 Zona - E17	2,809	-	-	-	-	-	-	-	0,405	2,405	-	-	-	-	-	-	
	A.1.2.4 Zona - E18	4,128	-	-	-	-	-	-	-	-	-	0,564	3,564	-	-	-	-	
	A.1.2.5 Zona - E19	2,935	-	-	-	-	-	-	1,468	1,468	-	-	-	-	-	-	-	
	A.1.2.6 Zona - E20	3,679	-	-	-	-	-	-	-	-	1,840	1,840	-	-	-	-	-	
	A.1.2.7 Zona - E21	4,612	-	-	-	-	-	-	-	-	2,306	2,306	-	-	-	-	-	
	A.1.2.8 Zona - E22	3,791	-	-	-	-	-	-	-	-	-	-	1,396	2,396	-	-	-	
	A.1.3 ROOF FRAME SPACE FRAME AREA INNER CIRCLE																	
	A.1.3.1 Zona - E23	1,775	-	-	-	-	-	-	-	-	-	0,388	1,388	-	-	-	-	
	A.1.3.2 Zona - E24	1,708	-	-	-	-	-	-	-	-	-	1,708	-	-	-	-	-	
	A.1.3.3 Zona - E25	2,626	-	-	-	-	-	-	-	-	-	-	-	1,313	1,313	-	-	
	A.1.3.4 Zona - E26	1,741	-	-	-	-	-	-	-	-	-	-	-	1,741	-	-	-	
	A.1.3.5 Zona - E27	2,062	-	-	-	-	-	-	-	-	-	-	-	-	2,062	-	-	
	Weekly Progress Weight Plan	100,000	3,058	7,535	8,727	10,474	11,078	10,895	10,045	8,492	7,720	6,805	6,347	5,450	3,375	-	-	
	Cumulative Weekly Progress Weight Plan		3,058	10,593	19,320	29,793	40,871	51,766	61,811	70,303	78,023	84,828	91,175	96,625	100,000	100,000	100,000	

Source : Author's Processed Data, 2025

CONCLUSION

The installation of the space frame roof structure on the Indonesia Arena GBK Jakarta Stadium Project was carried out by dividing the work into 27 zones. This zoning strategy was chosen to facilitate the erection process in stages, ensuring that each component is installed systematically, precisely, and safely to form a sturdy roof structure. Based on the results of the RAB calculation, the total cost of the work reached Rp57,572,349,543.00 with a roof area of 12,011 m², resulting in an installation cost of Rp4,793,250.00 per m². In terms of time, this work requires a duration of 105 calendar days, with effective working hours of 10 hours per day and implementation carried out 7 days a week. All of these methods and planning show the existence of structured work management to achieve the set quality, time, and cost targets.

REFERENCES

Edison Hatoguan Manurung, Alip Prajoko, Oloan Sitohang, Haryanto. (April 2023):Cost and Time Analysis of Steel Roof Structure Construction Work Using Portal Frames and Portal Trusses, Volume 6, Number 1, Journal of Civil Mechanics Construction Engineering (JRKMS), Medan.

Muhammad Wafi Hariry, Yayat Hendrayana. (2023): Technical Implementation of the Installation of Space Frame Truss Roof Structures in the GGM Majalengka Development Project, Civil Engineering Journal, Faculty of Engineering, University of Majalengka, Majalengka.

Michelle Gracia Uruilal, La Mohamat Saleh, Meyke Marantika. (2024): Analysis of the Cost and Time Plan for Installing a Profile Steel Roof Frame at the Honda Sales Office, Ambon Branch, Volume 1, Number 7, Jurnal Penelitian Multidisiplin Bangsa, Ambon.

Yolanda Azhar Susanti, Dewi Rachmaniatus, Tika Novis Putri. (2024): Methods for Constructing Wide-Span Structures at the Gelora Bung Karno Aquatic Stadium, Volume 14, Number 1, Journal of Architecture, Muhammadiyah University, Aceh. Indonesia Number KEP.102/MEN/VI/2004 Overtime Working Time and Overtime Wages, Jakarta: Department of Public Works.

M. Jazir Alkas, Dharwati P. Sari, Budi Haryanto, Nabila Aulia Rahmadanri. (2024): Project Cost and Time Control Using the Result Value Analysis Method Using Microsoft Project, Volume 1, Number 7, Journal of Tropical Engineering, Technology, and Innovation, East Kalimantan.

Dinda Fardilaa, Nurr Robbyatul Adwayahb. (2021): Optimizing Project Costs and Time Construction with Overtime and Additional Labor, Volume 17, Number 01, Civil Engineering Journal, Yogyakarta.

Kacapuri Journal. (2021): Comparison of Cost Budget Plans Between the SNI 2010 Method and Work Unit Price Analysis, Volume 4, Number 2, Civil Engineering Journal, Banjarmasin.

Mulyadi Sugih Dharsono, Arya Gilang. (2023): Comparative Study of Light Steel Roof Frame Construction Methods with Conventional Methods and Prefabricated Methods, Journal of Engineering Research and Reports, 25(8), 148–156.

Sugeng Hariyadi, Hanie Teki Tjendani, Budi Witjaksana. (2024): Cost and Time Analysis Using the Earned Value Analysis Method, Eduvest – Journal of Universal Studies, 4(9), 8273–8283.

Devita Putri Maharani, Ary Setyawan, Setiono. (2024): Time and Cost Optimization Analysis of Reservoir Building Work in Wosusokas Regional SPAM Project using Time Cost Trade Off Method, Sustainable Civil Building Management and Engineering Journal, 1(4), 1–12.