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Comparison of Time and Cost Efficiency: Conventional Scaffolding vs. Perth Construction Hire in Building Construction Projects (Case Study: Integrated Medical Education Building, Jenderal Soedirman University)

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Abstract* — The selection of scaffolding type is a crucial aspect in construction project execution, as it significantly affects time effectiveness and cost efficiency. This study aims to analyze the cost and time associated with the use of scaffolding and Perth Construction Hire (PCH) in the construction project of the IME Building at Jenderal Soedirman University (UNSOED), and to compare both methods in order to determine the most optimal alternative. The research employs a descriptive quantitative approach, conducted through observation and the collection of secondary data, including detailed engineering design (DED) drawings, Unit Price Analysis (AHSP), and price lists for scaffolding and PCH. The collected data were analyzed to calculate the time productivity and cost of each scaffolding method. The results indicate that PCH is more effective in terms of time, offering a saving of approximately 4 days or 20% compared to scaffolding. However, in terms of cost, scaffolding is more efficient, as the cost of using PCH is approximately 24% higher. Therefore, it can be concluded that PCH excels in time effectiveness, while scaffolding is more suitable for cost efficiency in the execution of this project.
Keywords: scaffolding; Perth Construction Hire; time; cost.

I. INTRODUCTION

The development of formwork construction technology has led to various scaffolding methods with distinct advantages. Choosing the ideal type of scaffolding is challenging because it affects cost efficiency, speed of dismantling, load-bearing capacity, and compliance with project specifications. Scaffolding serves as a platform for workers and materials in construction, with significant costs reaching 30–60% of the concrete budget (Respati et al., 2023). In Indonesia, commonly used scaffolding types are bamboo/wood scaffolds and modern scaffolding systems such as scaffolding and Perth Construction Hire (PCH).

Scaffolding is a metal material-based system that can be purchased or rented and is widely used in formwork work (Sajiwo, 2022). PCH, introduced in Perth, Australia, in 1985, offers the advantage of faster installation (2 days compared to scaffolding's 3 days) though its rental cost is higher (Ummah et al., 2023). The speed of PCH installation is a key factor for large projects requiring quick completion.

This study was conducted at Universitas Jenderal Soedirman (UNSOED), Purwokerto, on the Integrated Medical Education (IME) Building construction project, which uses scaffolding in formwork work. The study aims to compare the time effectiveness and cost efficiency of using scaffolding and PCH to provide recommendations for the best scaffolding choice in similar construction projects.

II. LITERATURE REVIEW

Management is a systematic process of planning, organizing, coordinating, and controlling resources to achieve goals efficiently and effectively. A project is a temporary effort with a clear start and end. Project management involves structured actions and tools to plan, allocate resources, execute, and control project activities It is a multidisciplinary field combining skills from engineering, social sciences, and economics, with varying involvement depending on the industry. (Andiyan A, et al. 2023)

Time management is a key factor in accelerating construction projects effectively and efficiently. Proper scheduling ensures optimal project outcomes, including the availability of skilled personnel. In addition to time, it is also important to consider work

quality and budget constraints in project completion (Sadono, S., & Purwono H, 2005) The Bill of Quantities (BoQ) presents a detailed calculation of the costs required for each work item in a construction project, aiming to produce an estimated total cost needed to complete the entire project (Sudjianto, et al. 2024):

BoQ=volume×unit price of work×coefficient…..……(1)

Scaffolding is a general term for prefabricated steel pipe scaffolds. The steel pipes used usually have an outer diameter of at least 48.3 mm (1 ½ inches) with a wall thickness of 3.25 mm. Smaller diameter pipes (1¼ inches) can be used for modular scaffolding systems that can be assembled and disassembled, but with a maximum height limit of 6 meters (equivalent to 3 elements).

Perth Construction Hire (PCH) is a superstructure construction method used in U-Residence, originating from Perth, Australia since 1985. The company that developed this method is certified with AS/NZ4801 for its workplace safety system. PCH uses iron pipes as its construction material. Its components consist of pipe rods connected by special bolts. These pipes are arranged vertically and horizontally at 90˚ angles or various other angles.

III. METHOD

The research location for this study is the construction of the Integrated Medical Education (IME) Building at Jenderal Soedirman University, located at Jl. Dr. Gumbreg No.1, Mersi, Purwokerto Kidul, South Purwokerto District, Banyumas Regency, Central Java 53147. The research method used in this study is quantitative descriptive, which aims to systematically, factually, and accurately describe phenomena through data analysis based on numbers or statistics. This research is grounded in the philosophy of positivism and conducted on a specific population or sample, enabling the researcher to measure the comparison of time and cost between the use of scaffolding and PCH in the construction project of the IME Building at UNSOED .

The data collection techniques include two types of data: primary and secondary. Primary data are collected directly through field observations, involving counts and placement positions of scaffolding. Meanwhile, secondary data are obtained from the contractor as supporting and comparative information, encompassing design drawings, unit prices of construction work, project schedules, and price lists of relevant scaffolding and PCH components used as sources for analysis.

The data analysis techniques in this study begin with formulating the problem and conducting a literature review to establish the objectives and methods. Secondary data such as price lists of scaffolding and PCH components are collected through field observation. Then, material needs are analyzed based on the quantity of scaffolding and PCH components. Duration analysis is performed using productivity figures according to field conditions, while cost analysis includes equipment rental, mobilization, and labor wages based on work rotations and unit prices. Subsequently, a comparison of time and cost between scaffolding and PCH in the IME Building project at UNSOED is conducted, followed by conclusions and recommendations regarding their effectiveness.techniques and data analysis techniques.

IV. RESULTS AND DISCUSSION

1. Analysis of scaffold costs

1.1 Calculation of Scaffolding Needs

The calculation of scaffolding and PCH requirements for the IME Building project at UNSOED was carried out using a mapping technique on beam and slab layouts, involving the analysis of working drawings to accurately determine the number of scaffolds needed. The project layout was divided into two areas: area A (rear building) and area B (lobby) to simplify calculations according to the building’s shape. After determining the dimensions of each area, the scaffolding requirement was obtained by dividing the total area of the building by the area of one scaffolding unit, taking into account the spacing between units to ensure accurate and efficient results in line with construction needs.

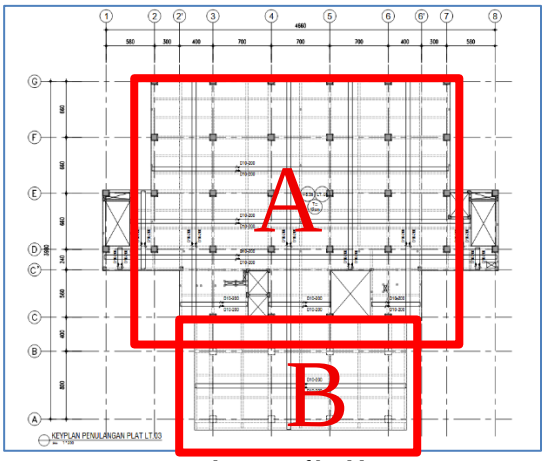

Figure 1. division of building areas
Source: PT. Krakatau Indah Margorejo(2025)

Based on research on the UNSOED IME Building construction project by PT. Krakatau Indah Mergorejo, scaffolding requirements were determined through beam and slab floor plans, a common method in construction planning for accurately calculating scaffolding requirements. Analysis of working drawings was used to optimize scaffolding usage. The floor plan was divided into two areas due to the building's asymmetrical shape: area A (35 m x 27.8 m) and area B (29 m x 12 m). Field observations revealed a need for 550 sets of scaffolding for area A (Rear Building) and 770 sets for area B (Lobby).

The following is the requirement for each component used in the scaffolding in area B (Lobby):

Table 1. The requirement for each component used in the scaffolding in area B (Lobby)

Back Building			
Number	**Component scaffolding**	**Need**	**Unit**
1	Main Frame T. 190	2531	pcs
2	Ledder Frame T.90	2531	pcs
3	Cross Brace 220	1367	pcs
4	Cross Brace 193	1367	pcs
5	U-Head T. 60	4102	pcs
6	Jack Base T.60	4102	pcs
7	Join Pin	4102	pcs

The following is the requirement for each component used in the scaffolding in area A (Rear Building):

Table 2. The requirement for each component used in the scaffolding in area A (Rear Building)

Lobby			
Number	**Component scaffolding**	**Need**	**Unit**
1	Main Frame T. 190	1583	pcs
2	Ledder Frame T.90	709	pcs
3	Cross Brace 220	472	pcs
4	Cross Brace 193	472	pcs
5	U-Head T. 60	1417	pcs
6	Jack Base T.60	1417	pcs
7	Join Pin	1417	pcs

1.2 Scaffolding Cost Calculation

The scaffolding cost calculation includes equipment rental costs, labor costs, and mobilization costs. The equipment rental used in this study was sourced from Mega Metal Scaffolding, a scaffolding rental service provider. The following summarizes the overall costs of scaffolding:

Table 3. summarizes the overall costs of scaffolding

Back Building							
Number	**omponer caffoldin**	**Need**	**Unit**	**Unit Price**		**Total**	
1	Frame T	2531	pcs	Rp	12,000	Rp	30,369,600
2	er Frame	2531	pcs	Rp	8,500	Rp	21,511,800
3	s Brace	1367	pcs	Rp	7,000	Rp	9,570,400
4	s Brace	1367	pcs	Rp	5,500	Rp	7,519,600
5	Head T.	4102	pcs	Rp	5,000	Rp	20,508,000
6	k Base T	4102	pcs	Rp	5,000	Rp	20,508,000
7	Join Pin	4102	pcs	Rp	500	Rp	2,050,800
	Total					Rp	224,076,400
Lobby							
Number	**omponer caffoldin**	**Need**	**Unit**	**Unit Price**		**Total**	
1	Frame T	1583	pcs	Rp	12,000	Rp	19,000,800
2	er Frame	709	pcs	Rp	8,500	Rp	6,023,100
3	s Brace	472	pcs	Rp	7,000	Rp	3,306,800
4	s Brace	472	pcs	Rp	5,500	Rp	2,598,200
5	Head T.	1417	pcs	Rp	5,000	Rp	7,086,000
6	k Base T	1417	pcs	Rp	5,000	Rp	7,086,000
7	Join Pin	1417	pcs	Rp	500	Rp	708,600
	Total					Rp	45,809,500
	Total Seluruhnya					Rp	269,885,900

installation of 1 m2 of scaffolding							
Number	**Description**	**coefficient & Volume**	**Unit**	**Unit Price (Rp)**		**Total Price (Rp)**	
A	**Labor**	**973**	**m2**				
	Worker	0.164	OH	Rp	100,000.00	Rp	16,000,000.00
	Craftsman	0.549	OH	Rp	100,000.00	Rp	53,423,076,920
	Chief craftsman	0.016	OH	Rp	105,000.00	Rp	56,094,230,770
	Foreman	0.016	OH	Rp	110,000.00	Rp	1,760,000.00
			Total labor price (A)			**Rp**	**127,277,307.69**
dismantling 1m2 of scaffolding							
Number	**Description**	**coefficient & Volume**	**Unit**	**Unit Price (Rp)**		**Total Price (Rp)**	
B	**Labor**	**973**	**m2**				
	Worker	0.099	OH	Rp	100,000.00	Rp	9,600,000.00
	Craftsman	0.549	OH	Rp	100,000.00	Rp	53,423,076.92
	Chief craftsman	0.010	OH	Rp	105,000.00	Rp	1,008,000.00
	Foreman	0.016	OH	Rp	110,000.00	Rp	1,056,000.00
			Total labor price (B)			**Rp**	**65,087,076.92**
			Total labor price			**Rp**	**192,364,384.61**

Mobilization Costs						
oden pickup truck	=	150	set			
round-trip cost	=	Rp 150,000				**Total Price**
		Lobby	Back Building			
number of trips	=	0.0	0.000	trips		
rounded up		5	4	trips	Rp	750,000
	only one use for the lobby		Since the back building is u		Rp	1,200,000
	=	5	8	trip	**Rp**	**1,950,000**
				Total mobilization cost	**Rp**	**195,022,984.61**
				Total scaffolding usage cost	**Rp**	**221,908,384.61**

1.3 Calculation of PCH Requirements

Calculating PCH requirements is essentially similar to calculating scaffolding requirements. In this study, PCH requirements were determined through a mapping process on the beam and slab plan. The following are the requirements for each PCH component

Table 4. The requirement for each component used in the PCH in Area Lobby (B)

Back Building			
Number	**Component PCH**	**Need**	**Unit**
1	Main Vertical	749	2 m
		500	1.2 m
2	Main Horizontal	4995	1 m
3	Jack Base	999	60
4	U-Head	999	60

Table 5. The requirement for each component used in the PCH in Area A (Rear Building)

Lobby			
Number	**Component scaffolding**	**Need**	**Unit**
1	Main Vertical	1186	2 m
		1186	1.2 m
2	Main Horizontal	9485	1 m
3	Jack Base	2371	60
4	U-Head	2371	60

1.4 Calculation of PCH Costs

The calculation of PCH costs is essentially the same as the costs used for scaffolding, including equipment rental costs, labor costs, and mobilization costs. The equipment rental used in this study was sourced from PT. Pratama 84 Cilegon, the PCH rental service provider. The following summarizes the overall costs of PCH usage:

Table 6. Summarizes the overall costs of PCH usage

Back Building							
Number	**Component PCH**	**Need**	**Unit**	**Unit Price**			**Total**
1	Main Vertical	749	2 m	Rp	21,000	Rp	15,734,250
		500	1.2 m	Rp	17,500	Rp	8,741,250
2	Main Horizontal	4995	1 m	Rp	10,000	Rp	49,950,000
3	Jack Base	999	60	Rp	15,000	Rp	74,925,000
4	U-Head	999	60	Rp	15,000	Rp	14,985,000
					Total	**Rp**	**164,335,500**
Lobby							
Number	**Component scaffolding**	**Need**	**Unit**	**Unit Price**			**Total**
1	Main Vertical	1186	2 m	Rp	21,000	Rp	24,897,600
		1186	1.2 m	Rp	17,500	Rp	20,748,000
2	Main Horizontal	9485	1 m	Rp	10,000	Rp	94,848,000
3	Jack Base	2371	60	Rp	15,000	Rp	35,568,000
4	U-Head	2371	60	Rp	15,000	Rp	35,568,000
					Total	**Rp**	**211,629,600**
					Total Price	**Rp**	**375,965,100**

installation of 1 m2 of scaffolding							
Number	**Description**	**coefficient & Volume**	**Unit**	**Unit Price (Rp)**			**Total Price (Rp)**
A	**Labor**	**973**	**m2**				
	Worker	0.132	OH	Rp	100,000.00	Rp	12,800,000.00
	Craftsman	0.901	OH	Rp	100,000.00	Rp	1,730.59
	Chief craftsman	0.016	OH	Rp	105,000.00	Rp	12,442.47
	Foreman	0.016	OH	Rp	110,000.00	Rp	237.96
					Total labor price (A)	**Rp**	**12,814,411.01**
dismantling 1m2 of scaffolding							
Number	**Description**	**coefficient & Volume**	**Unit**	**Unit Price (Rp)**			**Total Price (Rp)**
B	**Labor**	**973**	**m2**				
	Worker	0.164	OH	Rp	100,000.00	Rp	16,000,000.00
	Craftsman	0.934	OH	Rp	100,000.00	Rp	90,846,153.85
	Chief craftsman	0.176	OH	Rp	105,000.00	Rp	17,993,497.04
	Foreman	0.176	OH	Rp	110,000.00	Rp	18,850,330.23
					Total labor price (B)	**Rp**	**143,689,981.11**
					Total labor price	**Rp**	**156,504,392.12**

Mobilization Costs					
ooden pickup truck	=	100	vertikal		
	=	400	horizontal		
round-trip cost	=	Rp 1,500,000			**Total Price**
		Lobby	Back Building		
number of trips	=	10	18	trips	
	=	28		trips	
				Total mobilization cost **Rp**	**42,000,000.00**
				Total biaya penggunaan PCH **Rp**	**574,469,492.12**

2. Duration Analysis

2.1. Duration Analysis of Scaffolding

This sub-chapter discusses the analysis of scaffolding installation and dismantling durations to obtain an overview of the time required for each installation and dismantling process within the project. In this study, all duration data analyzed in this sub-chapter was taken directly from field observations. The following summarizes the scaffolding installation and dismantling times:

Table 7. Summarizes the scaffolding installation and dismantling times

Type of work	Time (Days)	Total (Hours)	Total (Days)
Scaffolding Installation	4	160	20
Scaffolding Demilition	2	96	12

2.2. Duration Analysis for PCH

The duration analysis for the PCH work phase was conducted based on a theoretical approach using standard formulas and data from relevant literature. Based on this approach, there are several steps in determining the duration analysis for PCH, starting with determining productivity, determining total work hours, and then determining the job duration. The following summarizes the PCH installation and dismantling times:

Table 7. Summarizes the PCH installation and dismantling times

Type of work	Time (Days)	Total (Hours)	Total (Days)
PCH Installation	2	160	20
PCH Demilition	2	96	16

3. Comparison of Time and Costs for Using the Two Types of Scaffolding

After all duration calculations have been performed, the time comparisons for the two types of scaffolding can be compared. The following is a comparison of the time between scaffolding and PCH:

Table 8. comparison of the time between scaffolding and PCH

Type of Scaffolding	Installation Time in 1 floor	Installation Time in all floors	Demilition Time in 1 floor	Installation in all floors
scafolding	4	28	2	20
PCH	2	20	2	16
Comparison	2	4	0	4

Based on the data in the table above, it can be seen that the use of PCH is more efficient than scaffolding in terms of installation and

dismantling time. For installation on a single floor, scaffolding requires 4 days, while PCH only requires 2 days, thus PCH can cut installation time in half. For installation of an entire floor, scaffolding requires 28 days, while PCH only requires 20 days. Similarly, the demolition time for one floor also takes 2 days, but overall, the total time required for the work with scaffolding is 20 days, while using PCH only takes 16 days. Thus, using PCH can save up to 4 days (or approximately 20%) compared to scaffolding for the entire work on the same project.

After determining the component requirements and calculating the costs, a cost comparison of scaffolding and PCH will be presented. The results of the cost comparison between scaffolding and PCH are as follows:

Based on the data in the table, the cost of scaffolding is Rp464,200,284.62, while the cost of using PCH is Rp574,469,492.12. The cost difference between the two is Rp110,269,207.51, with PCH being higher. Calculated as a percentage, the cost of using PCH is approximately 24% higher than scaffolding in the same case study. This shows that in terms of cost, the use of scaffolding is more economical than PCH for this project.

V. CONCLUSION

1. For the cost of using scaffolding in the IME Unsoed building construction project, the results of Rp. 464,200,284,62. As for the cost of using PCH in the IME Unsoed building construction project, the results of Rp. 574,469,492.12.
2. For the time of use of scaffolding in the IME Unsoed building construction project requires 4 days of installation for each floor. When viewed on the entire floor that must be installed, the time needed reaches 28 days. In addition, the scaffolding demolition stage for one floor also takes 2 days, the time needed is 20 days. As for PCH, it requires 2 days of installation time for each floor. When viewed on the entire floor that must be installed, the time needed reaches 20 days. In addition, the scaffolding demolition stage for one floor also takes 2 days, the time needed is 16 days.
3. For the comparison of time and cost of use of scaffolding and PCH in the Unsoed IME building construction project, it is obtained that the use of PCH is more efficient in terms of time, PCH is able to save up to 4 days (around 20%) than scaffolding. However, in terms of cost, the use of scaffolding is more economical, PCH requires a fee of around 24% higher than scaffolding. So, PCH offers time savings, while scaffolding is superior in terms of costs for this project.

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