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Comparisonal Analysis of Costs And Working Time Column Using Semi System Form and Aluminum Form in Building Project
Case Study : Osaka Riverview Apartment Project

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Abstract

In planning a building or infrastructure, various methods and strategies are needed to achieve the target for timely completion, resulting in a strong and beautiful quality building. Structural components such as foundations, columns, beams, and plates play an important role in supporting the establishment of a building. To produce the quality of the structural components required special skills in doing the job. Formwork has an important value as a mold (formwork) to form the dimensions of the structural components that have been planned. In this study, we will discuss the comparison of usage related to the cost and time of using different column formwork, namely semi-system formwork and aluminum formwork used to build multi-storey buildings. From the two types of formwork, the budget for formwork work will be analyzed to obtain an economical budget and efficient time.
The comparative analysis of formwork semi system and formwork aluminum get results, for formwork semi system requires a cost of Rp. 1,366,460,000 with an implementation time of 35 days while using aluminum formwork is Rp. 1,114,460,000 with an implementation time of 20 days. This means that using semi system formwork is more expensive by Rp. 252,000,000 compared to semi system formwork. Meanwhile, the implementation time for aluminum formwork is 15 days faster than semi-system formwork.

Keywords
Formwork, Semi System, Aluminum, Cost, Time.

1. Introduction

In planning a building or infrastructure, various methods and strategies are needed to achieve the target for timely completion, resulting in a strong and beautiful quality building. Structural components such as foundations, columns, beams, and plates play an important role in supporting the establishment of a building. To produce the quality of the structural components required special skills in doing the job. Formwork has an important value as a mold (formwork) to form the dimensions of the structural components that have been planned. In this study, we will discuss the comparison of usage related to the cost and time of using different column formwork, namely semi-system formwork and aluminum formwork used to build multi-storey buildings. From the two types of formwork, the budget for formwork work will be analyzed to obtain an economical budget and efficient time.

The Osaka Riverview Apartment Development Project has 3 towers, namely Tower A, Tower B, and Tower C. Among the three towers, Tower C experienced a delay where the deviation of the delay was 4.8%. Factors that cause delays include delays related to material and labor. This disrupts the work of none other than the formwork work.

2.2. Methodology

2.1. Research Location and Time

This research was conducted on a project built by PT. Majumapan Bangunindo in the beautiful kapok beach area, North Jakarta. The project that will be the subject of this research is the construction of a 3 tower building with 32 floors, which was carried out in 2019 with a planned completion in 2022.

2.2. Data Collection

The data collection required is primary data and secondary data. The primary data in this study were obtained directly from the respondents by reviewing the field and interviewing experts.

Secondary data is a collection of data and information obtained from the literature and theories that have existed before. Then the existing data will be used as a hypothesis material in the process of running this research. Other supporting data are work drawings, work schedules and bill of quantity, from the collected data it will be processed and produce data analysis, from the analysis of these data conclusions and suggestions can be drawn from the research.

3. Results and Analysis

3.1. Research data

The formwork in the Osaka Riverview Apartment Project is implemented using the Semi System and Aluminum Formwork method. Both calculations use the volume and procurement of materials and tools that are almost the same, only a few are different, one example of the Semi System support mainly using scaffolding while the Aluminum Formwork uses vertical support. In this study, it is limited from the vertical elements (columns) from the 20th floor to the 24th floor which is located in tower C.

Table 1. Floor Column Identification

No	Column Type / Shearwall	Concrete Quality	Dimension			Qty	Volume /Unit (m^2)	Total (m^2)
			P	L	T			
1	C 1	Fc 45Mpa + Fa 15%	0.4	0.9	2.3	3	5.98	17.94
2	C 1A	Fc 45Mpa + Fa 15%	0.4	0.9	2.3	13	5.98	77.74
3	C 1B	Fc 45Mpa + Fa 15%	0.2	0.9	2.3	4	5.06	20.24
4	C 2	Fc 45Mpa + Fa 15%	0.4	0.9	2.3	6	5.98	35.88
5	C 4	Fc 45Mpa + Fa 15%	0.4	0.9	2.3	15	5.98	89.7
6	SW 2A	Fc 45Mpa + Fa 15%	1.696		2.3	1	3.90	3.90
7	SW 2B	Fc 45Mpa + Fa 15%	1.696		2.3	1	3.90	3.90
8	SW 3A	Fc 45Mpa + Fa 15%	1.74		2.3	1	4.00	4.00
9	SW 3B	Fc 45Mpa + Fa 15%	1.82		2.3	1	4.19	4.19
10	SW 4	Fc 45Mpa + Fa 15%	3.85		2.3	1	8.86	8.86
11	SW 5	Fc 45Mpa + Fa 15%	0.4	3.75	2.3	2	19.09	38.18
12	SW 5A	Fc 45Mpa + Fa 15%	0.4	3.45	2.3	2	17.71	35.42
		Sub Total				50	90.62	339.94

Table 2. Identify the Column under review

Sub Total 20 Floor	339.94	m^2
Sub Total 21 Floor	339.94	m^2
Sub Total 22 Floor	339.94	m^2
Sub Total 23 Floor	339.94	m^2
Sub Total 24 Floor	339.94	m^2
Total Overall Floor reviewed	1699.72	m^2

3.2. Formwork Work Time Analysis

In the time analysis to be carried out, the duration is obtained from the analysis of productivity and cycle time, then after obtaining the total duration of the work of the two work methods, a comparison is made to the time performance of the two methods which can be seen in the table below.

Table 3. Time Comparison Analysis Results

No	Work item	Duration (Minutes) Semi System	Duration (Minutes) Aluminum
1	Loading time		
-	Prepare materials & equipment	20	5
2	Instailing time		
-	Column shoe installation	10	5
-	Formwork installation	20	15
-	Reinforcement	10	5
	Total duration (Minutes)	60	30
	Difference	30	

3.2.1. Semi System Formwork Time Analysis

Is known :
Total Total number of columns = 50 pieces
Outside the total area of the column = 339.94 m²
The size of 1 set of formwork is taken the average area of the formwork

$$\frac{area}{Total\ column} = \frac{339.94}{50} = 6.79\ set \sim 6.8\ set$$

$$\text{So}: \frac{area}{uk.1\ set} = \frac{339.94}{14.95} = 49.9 \sim 50\ set$$

$$Number\ set\ 1\ Floor\ x\ time = 50\ x\ 60\ minutes = 3000$$

$$\frac{Time\ /set}{Effective\ working\ time} = \frac{3000}{420} = 7.14\ days \sim 7\ days$$

3.2.2. Semi System Formwork Time Analysis

$$\frac{area}{uk.1\ set} = \frac{339.94}{6.8} = 49.9\ \sim 50\ set$$

$$Number\ set\ 1\ Floor\ x\ time = 50\ x\ 30\ minutes = 1500$$

$$\frac{Time\ /set}{Effective\ working\ time} = \frac{1500}{420} = 3.57\ days \sim 4\ days$$

3.3. Cost Comparison Analysis

Cost analysis is needed to determine the amount of costs required for each implementation method used in the implementation of construction projects. To get a cost comparison analysis between semi-system formwork and aluminum formwork, process the data obtained from the Osaka Riverview Apartment Project, including the volume of work, labor cost analysis, and unit price analysis.

Table 4. Column Formwork Volume

	Work item	Unit	Volume
A.	Column (Vertical)		
	Column 20 Floor	m²	241.5
	Column 21 Floor	m²	241.5
	Column 22 Floor	m²	241.5
	Column 23 Floor	m²	241.5
	Column 24 Floor	m²	241.5
	Sub Total		1207.5
B.	Shearwall (Vertical)		
	Shearwall 20 Floor	m²	98.44
	Shearwall 21 Floor	m²	98.44
	Shearwall 22 Floor	m²	98.44
	Shearwall 23 Floor	m²	98.44
	Shearwall 24 Floor	m²	98.44
	Sub Total		492.22
	Total Vertical Formwork (A+B)		1699.72

3.3.1. Price Analysis of Semi System Formwork Direct Costs

Table 5. Semi System Formwork Unit Price Analysis

	Work Item	Materials and Wages Analysis				Work Unit Price
		Koef.	Sat	Price	Jumlah price	
A.	Column Work Ingredients					
	Hollow 40x40	0.167	Btg	80,000	13,333.33	
	Hollow 50x100	0.167	Btg	385,000	64,166.67	
	Multiplek 12mm/18mm	0.347	Lbr	250,000	86,750.00	
	Paku 5/7	0.220	Kg	29,500	6,490.00	
	Oils Form	0.200	Liter	65,000	13,000.00	
	Sub Total (A)					183,740.00
B.	Wages					
	Worker	0.220	OH	140,000	30,800.00	
	Carpenter	0.110	OH	160,000	17,600.00	
	Foreman	0.011	OH	175,000	1,925.00	
	Foreman	0.022	OH	185,000	4,070.00	
	Sub Total (B)					54,395.00
	Total (A+B)					238,135.00
	Rounded					238,000.00

Table 6. Semi System Formwork Cost Recapitulation

	Work Item	Sat	Volume	Unit price	Jumlah
A.	Kolom (Vertical)				
	Column 20 Floor	m²	241.5	238,000.00	57,477,000
	Column 21 Floor	m²	241.5	238,000.00	57,477,000
	Column 22 Floor	m²	241.5	238,000.00	57,477,000
	Column 23 Floor	m²	241.5	238,000.00	57,477,000
	Column 24 Floor	m²	241.5	238,000.00	57,477,000
	Sub Total		1207.5		287,385,000
B.	Shearwall (Vertical)				
	Shearwall 20 Floor	m²	98.44	238,000.00	23,429,815
	Shearwall 21 Floor	m²	98.44	238,000.00	23,429,815
	Shearwall 22 Floor	m²	98.44	238,000.00	23,429,815

	Shearwall 23 Floor	m²	98.44	238,000.00	23,429,815
	Shearwall 24 Floor	m²	98.44	238,000.00	23,429,815
	Sub Total		492.22		117,149,074
	Total Vertical Formwork (A+B)		1699.72		404,534,074
	Rounded				405,000,000

Based on the author's analysis, it can be concluded that the costs incurred for the semi system formwork work from the 20th floor to the 24th floor column is Rp. 405,000,000,-

3.3.2. Price Analysis of Direct Cost of Aluminum Formwork

Table 7. Semi System Formwork Cost Recapitulation

	Work Item	Materials and Wages Analysis				Work Unit Price
		Koef.	Sat	Pricw	Total Price	
	Column Work					
A.	Ingredients					
	Alumunium	0.336	m²	425,200	142,867.20	
	Pin	2.000	kg	35,500	71,000.00	
	Paku 5/7	0.220	kg	29,500	6,490.00	
	Oils Form	0.200	liter	65,000	13,000.00	
	Prop Shore	0.368	set	51,200	18,841.60	
	Sub Total (A)					252,198.80
B.	Wages					
	Worker	0.220	OH	140,000	30,800.00	
	Carpenter	0.110	OH	160,000	17,600.00	
	Foreman	0.011	OH	175,000	1,925.00	
	Foreman	0.022	OH	185,000	4,070.00	
	Sub Total (B)					54,395.00
	Total (A+B)					306,593.80
	Rounded					307,000.00

Table 8. Aluminum Formwork Cost Recapitulation

	Work Item	Sat	Volume	Unit Price	Total
A.	Column (Vertical)				
	Column 20 Floor	m²	241.5	307,000.00	74,140,500
	Column 21 Floor	m²	241.5	307,000.00	74,140,500
	Column 22 Floor	m²	241.5	307,000.00	74,140,500
	Column 23 Floor	m²	241.5	307,000.00	74,140,500
	Column 24 Floor	m²	241.5	307,000.00	74,140,500
	Sub Total		1207.5		370,702,500
B.	Shearwall (Vertical)				
	Shearwall 20 Floor	m²	98.44	307,000.00	30,222,492
	Shearwall 21 Floor	m²	98.44	307,000.00	30,222,492
	Shearwall 22 Floor	m²	98.44	307,000.00	30,222,492
	Shearwall 23 Floor	m²	98.44	307,000.00	30,222,492
	Shearwall 24 Floor	m²	98.44	307,000.00	30,222,492
	Sub Total		492.22		151,112,461
	Total Vertical Formwork (A+B)		1699.72		521,814,961
	Rounded				522,000,000

Based on the author's analysis, it can be concluded that the costs incurred for aluminum formwork work from the 20th floor to the 24th floor column are Rp. 522,000,000,-

3.4. Indirect Cost Analysis

Indirect costs or overhead costs and equipment are costs that continue to run over time during project implementation. The longer the execution of the work, the higher the cost will be. The duration of the column structure work is 7 days x 5 floors = 35 days while the structural work using aluminum is 4 days x 5 floors = 20 days. The following is the calculation of indirect costs using a semi system and aluminum.

Table 9. Semi System Formwork Work Staff Cost

No	Description	Unit Price		Unit (Person)	Volume	Duration	
1	Site Manager	Rp	10,000,000	1	1.17	Rp	11.700.000
2	Pelaksana	Rp	7,000,000	1	1.17	Rp	8.190.000
3	Surveyor	Rp	5,500,000	2	1.17	Rp	6.435.000
4	Engineering	Rp	6,000,000	1	1.17	Rp	7.020.000
5	Logistik	Rp	4,500,000	1	1.17	Rp	5.265.000
6	Admins	Rp	4,000,000	1	1.17	Rp	4.680.000
			Total			Rp	43.290.000

Table 10. General Cost of Semi System Formwork Work

No	Description	Unit Price		Jlh	Sat	Time period	Duration	
1	Office							
	Office building	Rp	30,000,000	1	Ls		Rp	30,000,000
	Computer	Rp	4,000,000	10	Ls		Rp	40,000,000
	Printer	Rp	1,500,000	5	Ls		Rp	7,500,000
	Office stationery	Rp	3,000,000	1	Bln	1.17	Rp	3.510.000
	Electrical work	Rp	20,000,000	1	Bln	1.17	Rp	23.400.000
	Water work	Rp	1,500,000	1	Bln	1.17	Rp	1.755.000
	Drinking water	Rp	20,000	30	Bln		Rp	600,000
	Rubbish	Rp	500,000	1	Bln	1.17	Rp	585.000
	Wifi	Rp	3,000,000	1	Bln	1.17	Rp	3.510.000
	Meals pegawai	Rp	15,000,000	1	Bln	1.17	Rp	17.550.000
	Mess staff	Rp	25,000,000	1	Ls	1.17	Rp	29.250.000
	Site meeting	Rp	3,000,000	1	Bln	1.17	Rp	3.510.000
	Project security	Rp	10,000,000	1	Bln	1.17	Rp	11.700.000
2	Equipment							
	Safety shoes	Rp	250,000	30	Bh		Rp	7,500,000
	Vest	Rp	100,000	30	Bh		Rp	3,000,000
	P3K	Rp	3,000,000	1	Ls		Rp	3,000,000
	Body harness	Rp	200,000	20	Bh		Rp	4,000,000
	Hard hats	Rp	80,000	30	Bh		Rp	2,400,000
3	Equipment							
	Tower crane	Rp	90,000,000	1	Unit	1.17	Rp	105.300.000
	Mob/Demob TC	Rp	95,000,000	1	Ls	1.17	Rp	111.150.000
	Fitting/Dismantle TC	Rp	95,000,000	1	Ls	1.17	Rp	111.150.000
	Operator TC	Rp	15,000,000	2	OH	1.17	Rp	17.550.000
	Genset 350kVa	Rp	20,000,000	1	Unit	1.17	Rp	23.400.000
	Mob/Demob Genset	Rp	10,000,000	1	Ls	1.17	Rp	11.700.000
	Alat survey	Rp	50,000,000	1	Set	1.17	Rp	58.500.000
	Passanger hoist	Rp	75,000,000	1	Unit	1.17	Rp	87.750.000
	Mob/Demob PH	Rp	80,000,000	1	Ls	1.17	Rp	93.600.000
	Fitting/Dismantle PH	Rp	80,000,000	1	Ls	1.17	Rp	93.600.000
	Operator PH	Rp	10,000,000	2	OH	1.17	Rp	11.700.000
			Total				Rp	918.170.000

Table 11. Aluminum Formwork Work Staff Cost

No	Descriptions	Unit Price		Unit (Person)	Volume	Durations	
1	Site Manager	Rp	10,000,000	1	0.67	Rp	6.700.000
2	Pelaksana	Rp	7,000,000	1	0.67	Rp	4.690.000
3	Surveyor	Rp	5,500,000	2	0.67	Rp	3.685.000
4	Engineering	Rp	6,000,000	1	0.67	Rp	4.020.000
5	Logistik	Rp	4,500,000	1	0.67	Rp	3.015.000
6	Admin	Rp	4,000,000	1	0.67	Rp	2.680.000
			Total			Rp	24.790.000

Table 12. General Cost of Aluminum Formwork Works

No	Description	Unit Price		Jlh	Sat	Time period	Duration	
1	Office							
	Office building	Rp	30,000,000	1	Ls		Rp	30,000,000
	Computer	Rp	4,000,000	10	Ls		Rp	40,000,000
	Printer	Rp	1,500,000	5	Ls		Rp	7,500,000
	Office stationery	Rp	3,000,000	1	Bln	0.67	Rp	2.010.000
	Electrical work	Rp	20,000,000	1	Bln	0.67	Rp	13.400.000
	Water work	Rp	1,500,000	1	Bln	0.67	Rp	1.005.000
	Drinking water	Rp	20,000	30	Bln		Rp	600,000
	Rubbish	Rp	500,000	1	Bln	0.67	Rp	335.000
	Wifi	Rp	3,000,000	1	Bln	0.67	Rp	2.010.000
	Meals pegawai	Rp	15,000,000	1	Bln	0.67	Rp	10.050.000
	Mess staff	Rp	25,000,000	1	Ls	0.67	Rp	16.750.000
	Site meeting	Rp	3,000,000	1	Bln	0.67	Rp	2.010.000
	Project security	Rp	10,000,000	1	Bln	0.67	Rp	6.700.000
2	Equipment							
	Safety shoes	Rp	250,000	30	Bh		Rp	7,500,000
	Vest	Rp	100,000	30	Bh		Rp	3,000,000
	P3K	Rp	3,000,000	1	Ls		Rp	3,000,000
	Body harness	Rp	200,000	20	Bh		Rp	4,000,000
	Hard hats	Rp	80,000	30	Bh		Rp	2,400,000
3	Equipment							
	Tower crane	Rp	90,000,000	1	Unit	0.67	Rp	60.300.000
	Mob/Demob TC	Rp	95,000,000	1	Ls	0.67	Rp	63.650.000
	Fitting/Dismantle TC	Rp	95,000,000	1	Ls	0.67	Rp	63.650.000
	Operator TC	Rp	15,000,000	2	OH	0.67	Rp	10.050.000
	Genset 350kVa	Rp	20,000,000	1	Unit	0.67	Rp	13.400.000
	Mob/Demob Genset	Rp	10,000,000	1	Ls	0.67	Rp	6.700.000
	Alat survey	Rp	50,000,000	1	Set	0.67	Rp	33.500.000
	Passanger hoist	Rp	75,000,000	1	Unit	0.67	Rp	50.250.000
	Mob/Demob PH	Rp	80,000,000	1	Ls	0.67	Rp	53.600.000
	Fitting/Dismantle PH	Rp	80,000,000	1	Ls	0.67	Rp	53.600.000
	Operator PH	Rp	10,000,000	2	OH	0.67	Rp	6.700.000
			Total				Rp	567.670.000

3.5. Conclusion of Comparative Analysis Results

Based on the data above, the costs incurred related to the use of formwork for implementation in the field are obtained. The results of the cost comparison can be seen in the table below :

Table 13. Direct Cost Comparison Results

Work Item		Sat	Vol	Semi System		Alumunium	
				Unit Price	Total	Unit Price	Total
A.	Column						
	20 Floor	m²	241.5	238,000	57,477,000	307,000	74,140,500
	21 Floor	m²	241.5	238,000	57,477,000	307,000	74,140,500
	22 Floor	m²	241.5	238,000	57,477,000	307,000	74,140,500
	23 Floor	m²	241.5	238,000	57,477,000	307,000	74,140,500
	24 Floor	m²	241.5	238,000	57,477,000	307,000	74,140,500
	Sub Total		1207.5		287,385,000		370,702,500
B.	Shearwall						
	20 Floor	m²	98.44	238,000	23,429,815	307,000	30,222,492
	21 Floor	m²	98.44	238,000	23,429,815	307,000	30,222,492
	22 Floor	m²	98.44	238,000	23,429,815	307,000	30,222,492
	23 Floor	m²	98.44	238,000	23,429,815	307,000	30,222,492
	24 Floor	m²	98.44	238,000	23,429,815	307,000	30,222,492
	Sub Total		492.22		117,149,074		151,112,461
Formwork Total (A+B)			1699.72		404,534,074		521,814,961
Rounded					405,000,000		522,000,000

Table 14. Indirect Cost Comparison Results

	Direct Cost	Indirect Cost	Total Cost	Difference
Semi System	405,000,000	961.460.000	1,366.460.000	252.000.000
Alumunium	522,000,000	592.460.000	1.114.460.000	

Based on the analysis above, it can be concluded that using a semi system formwork costs more. Meanwhile, using aluminum in terms of quality, fast processing time and rework costs which when done using the aluminum method are less.

Table 15. Time and Cost Comparison Results

No	Work Area	Volume (m²)	Semi System			Aluminium		
			Duration Time (Days)	Direct Cost	Indirect Cost	Duration Time (Days)	Direct Cost	Indirect Cost
1	20 Floor	339.94	7	80,906,815	192.252.000	4	104,362,992	118.492.000
2	21 Floor	339.94	7	80,906,815	192.252.000	4	104,362,992	118.492.000
3	22 Floor	339.94	7	80,906,815	192.252.000	4	104,362,992	118.492.000
4	23 Floor	339.94	7	80,906,815	192.252.000	4	104,362,992	118.492.000
5	24 Floor	339.94	7	80,906,815	192.252.000	4	104,362,992	118.492.000
Total		1699.72	35	405,000,000	961.460.000	20	522,000,000	592.460.000
Sub Total				1.366.460.000			1.114.460.000	

3.6. Expert Validation

Validation of this stage is given to experts who are experienced in the field of building construction. This expert validation aims to find out and ask for expert opinions about how the research has been done. After validating several experts, the following conclusions can be drawn:

a. Working Process

In the process of working, using semi-aluminum formwork takes faster than semi-system formwork because aluminum formwork is already in the form of panels that have been numbered on each panel, while the step-by-step semi-system formwork is too much.

b. Quality of Work

On the quality of work, the semi-system formwork is not precise and causes lines on the concrete because it follows the plywood cut, while the results obtained using aluminum formwork are more precise because it was planned in advance and the concrete results also follow the plan.

c. Labor

In working on columns using semi-system formwork, it requires more power and also requires experts, compared to using aluminum formwork, it only requires less energy and does not require experts.

d. Implementation Budget

Using semi-system formwork requires more costs and if the work results in rework, the costs incurred are quite large compared to using aluminum formwork which requires lower costs and also minimal risk.

e. Project Completion Speed

Using semi system formwork takes 7 days to work on 1 floor while using aluminum formwork takes 4 days to work on 1 floor.

4. Conclusion

Based on the results of research conducted by the author regarding the comparison of the semi system formwork method and aluminum formwork on the Osaka Riverview Apartment project, the authors can conclude including:

1. Based on research for cost analysis using semi system formwork and aluminum formwork, it can be concluded in the table below.

Table 16. Cost Comparison Conclusion

No	Area Pekerjaan	Volume (m^2)	Semi System		Aluminium	
			Direct Cost	Indirect Cost	Direct Cost	Indirect Cost
1	20 Floor	339.94	80,906,815	192.252.000	104,362,992	118.492.000
2	21 Floor	339.94	80,906,815	192.252.000	104,362,992	118.492.000
3	22 Floor	339.94	80,906,815	192.252.000	104,362,992	118.492.000
4	23 Floor	339.94	80,906,815	192.252.000	104,362,992	118.492.000
5	24 Floor	339.94	80,906,815	192.252.000	104,362,992	118.492.000
Total		1699.72	405,000,000	961.460.000	522,000,000	592.460.000
Sub Total			1.366.460.000		1.114.460.000	
Different			252.000.000			
Percentage			18.44%			

Based on the above analysis, it can be concluded that the semi-system formwork costs Rp. 1,366,460,000, or 18.44% of the value of the aluminum formwork. Taking into account the execution time, the use of aluminum formwork is faster and also the potential for rework is small.

2. Based on research for time analysis using semi system formwork and aluminum formwork, it can be concluded in the table below.

Table 16. Time Comparison Conclusion

No	Work Area	Volume (m^2)	Semi System Durasi Waktu		Aluminium Durasi Waktu	
			1 Set (Minutes)	1 Floor (Days)	1 Set (Minutes)	1 Floor (Days)
1	20 Floor	339.94	60	7	30	4
2	21 Floor	339.94	60	7	30	4
3	22 Floor	339.94	60	7	30	4
4	23 Floor	339.94	60	7	30	4
5	24 Floor	339.94	60	7	30	4
Sub Total				35		20
Different (Days)					15	

It can be concluded that the duration of using semi system formwork takes 35 days with a review of 5 floors, while using aluminum formwork takes 20 days with a review of 5 floors.

5. Suggestion

Based on the results of research conducted by the author regarding the comparison of semi system formwork work methods and aluminum formwork on the Osaka Riverview Apartment project, the authors provide suggestions for readers and for further research including:

1. Before determining the work method to be used, it is advisable to do an apple to apple comparison of the cost and time of implementation between the two comparators.

2. The thing that needs to be considered is that the planned duration of work must be achieved based on a mutually agreed work method that refers to the consideration of aspects of work risk, cost, and implementation time.
3. For the project owner, if you prioritize fast time, relatively cheap workmanship and environmentally friendly, then use aluminum formwork.

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