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Analysis of the Precast Half Slab Method in Batang I Industrial Workers Flats Development Project

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ABSTRACT

This study aims to analyze the application of Precast Half Slab formwork with conventional formwork in terms of cost, time, and implementation stages. The method used in this study is the precast half slab method. The Batang I Industrial Worker Flats project is in the Batang Integrated Industrial Estate. In the highly advanced construction era, many projects compete to innovate to produce a fast and efficient building. This Project uses the precast half slab method, where half of the floor slab is printed offsite (precast) with a thickness of 7 cm, and the other half is in place (topping 5.5 cm). This final Project analyzes the precast half slab method used by comparing it to the conventional method in terms of cost and time, so it can be seen which method is more profitable. The precast half-slab method analysis focuses on calculating the direct cost of conventional half-slab precast in terms of materials, tools, and worker wages, as well as calculating the time needed for each job.

1. Introduction

In competition to complete a project with good quality and a short time, a contractor is required to innovate in carrying out the work of a project [1]. In the Batang I Industry Worker Flats Development Project, using the Lean Construction / Downsizing Method [2]. The goal of Lean Construction is to maximize the value achieved by minimizing waste [3]. This study will analyze one of the methods, namely the use of precast half-slab formwork on reinforced concrete slabs of the Batang I Industry Worker Flats Development Project. This study aims to analyze the application of precast half-slab formwork using conventional formwork in terms of cost, time, and implementation stages [4].

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In today's advanced construction world, all contractors are competing to offer good-quality construction products with a shorter and cheaper implementation period [5]. Based on the above, the Batang I Industrial Worker Flats Development Project is one of the national strategic projects planned by the Government through the Ministry of Public Works and Public Housing. Ten tower buildings are being worked on, out of 10 towers PT.PP (Persero) Tbk is entrusted to work on four towers, while PT Abadi Prima Inti Karya is working on 3, and 3 more are being worked on by PT Brantas Abipraya. Each tower consists of 5 floors with the same type of structure and has a short time so that the work can be completed quickly and simultaneously with the PT. PP (Persero) Tbk Project uses the Precast Half Slab system [6]. The advantages of using the Precast Half Slab method include [7]:

1. Acceleration of work in the field, especially in formwork systems, compared to conventional systems.
2. There is no formwork demolition work, so the efficiency of using tools in the field.
3. Cost efficiency compared to conventional systems.

Regarding projects, construction projects are development efforts with a budget, timeframe, and quality that have determined the scope of work, majoring in civil engineering and architecture [8]. For the implementation of a construction project to run well, it is necessary to do good planning before the development process is carried out [9] of the many methods developed in the stages of development. Of course, the casting of floor slabs has also experienced results in the method of work [10]. Slab work is structural work that takes the longest time because most contractor companies use this conventional method [11]. The alternative construction is semi-precast concrete construction, where the concrete has been made at the factory/worked well for the most part; the shape is suitable, then it is assembled according to site identification and continues to manufacture of other elements that have not been worked on, for example, half slabs [12]. Concrete is the main material used in the manufacture of buildings. Concrete consists of cement, aggregate (coarse aggregate, fine aggregate), and water [13]. Advances in concrete technology enable lightweight structural aggregate concrete to be mass-produced with compressive strengths between 17.24 – 41.36 Mpa [14]. The selection of the use of precast concrete is not only based on economic aspects, efficiency, and speed in its implementation [15]. However, it also relates to environmental impacts related to production inputs and outputs) [16]. The function of the Precast Half Slab method is as a structural component, namely a composite plate structure, so it needs to be reviewed from the point of view of technical analysis and structural efficiency [17]. The precast and prestressed structural system is one of the manufactures of industrial-based construction systems that are in accordance with the concept of Industry 4.0 to support sustainable infrastructure development including against earthquake loads with an economical Life Cycle Cost [18]. Compared to previous research, the novelty of this research is the half slab method with 24-hour lifting, which usually takes three days, whereas, in this study, one day was sufficient. The purpose of this study is to analyze the application of the use of Precast Half Slab formwork with conventional formwork in terms of cost, time and implementation stages.

2. Methodology

In the Analysis of the Precast Half Slab Method in the Construction of Workers' Flats in the Batang I Industry, the method used compares the precast half slab method with the conventional method in terms of work time and implementation costs [19] so that you can get which method is faster and which is cheaper.

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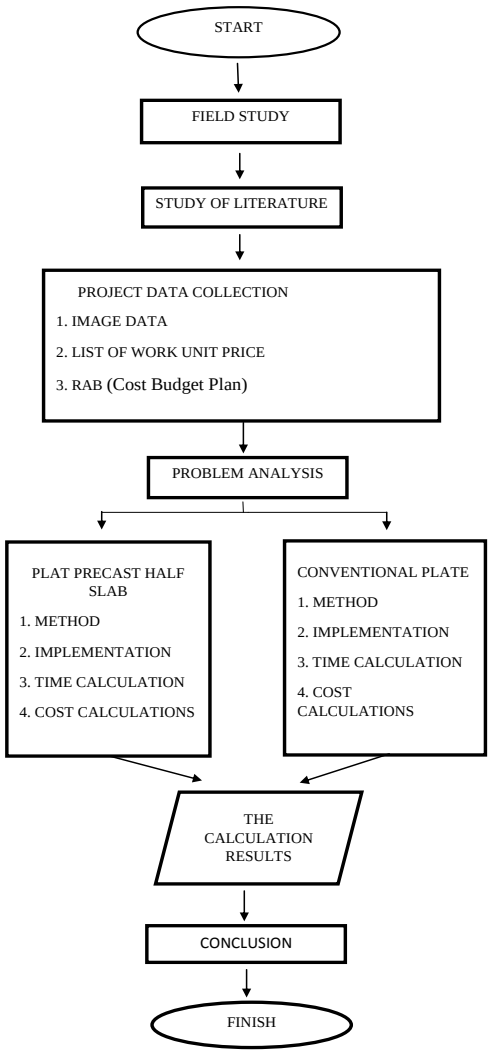

Figure 1. Research Flowchart

1. Field Study

   Field study is a scientific way that is carried out with a design to obtain more accurate results. Field studies are carried out by reviewing the Project so that problems can be made following conditions in the field.
2. Study of Literature

   In the early stages of making this Final Project, namely a literature review related to case studies from journals, articles, and surveys at the project location.
3. Project Data Collection

   The data collected includes image data, a price list of work units, and RAB.
4. Problem Analysis
5. Comparison between the precast half slab and conventional plate regarding the method, implementation, time analysis, and cost analysis can be seen.
6. The Calculation Result

   After all the research series have been carried out, the next thing that can be done is to carry out the calculation results from the data obtained from the research.
7. Conclusion

   The conclusion of the research is a brief statement about the results of the descriptive analysis and a discussion of the results of the hypothesis testing that has been done in the previous chapter. The conclusion contains the answers to the questions posed in the problem formulation section.

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3. Results and Discussions

Cost analysis for slab work using the Precast Half Slab and conventional methods is calculated using the RAB (Cost Budget Plan) of the Batang I Industrial Worker Flats Development Project.

Table 1. List of Wage Unit Prices

No	Description	Sat	Volume	Unit Price
A	Wage			
1	Urug Sirtu Wages	m^3		IDR 20.000,00
2	Sand Urug Wages	m^3		IDR 20.000,00
3	Foundry Wages	m^3		IDR 36.000,00
4	Redemption Wages	kg		IDR 850,00
5	Work Floor Wages	m^3		IDR 20.000,00
6	Wages to Install River Stones	m^3		IDR 100.000,00
7	Wages for Installing Bricks	m^2		IDR 25.000,00
8	Wiremesh Repair Fee	kg		IDR 645.000,00
9	Plastering Wages	m^2		IDR 20.000,00
10	Acian Wages	m^2		IDR 13.000,00
11	Skimcoat Wages	m^2		IDR 20.000,00

Source: Flatworker Industry Batang I Project Data

Based on the table above, it can be seen that each wage unit price is different. For example, the wage for stone sand piled up per m^3 is IDR 20,000.00, and so on.

Table 2. Material Unit Price Data

No	Description	Sat	Volume	Unit Price
B	Ingredient			
1	Sirtu	m^3		IDR 120.000, 00
2	Urug Sand	m^3		IDR 150.000, 00
3	Portland Cement	kg		IDR 1.150, 00
4	Chicken Wire	m^2		IDR 30.000, 00
5	Steel Bar	kg		IDR 8.550, 00
	Ready mix concrete K350 (FC 30)			
6	Slump 16+2	m^3		IDR 816.800, 00
7	Ready mix concrete K350 (FC 30)	m^3		IDR 786.800, 00
8	K175 ready-mix concrete	m^3		IDR 662.000, 00
9	K125 ready-mix concrete	m^3		IDR 642.100, 00
10	Wire mesh M8-150 threaded iron	kg		IDR 9.550, 00
11	Mount Sand	m^3		IDR 150.000, 00
12	Metal Cutting Drill 10	kg		IDR 8.616, 90
13	9 mm multiplex formwork	m^2		IDR 110.000, 00
14	Canal C 75, t=2,3	stem		IDR 100.000, 00

Source: Flatworker Industry Batang I Project Data

Based on the table above, it can be seen that each material unit price is different. For example, the cost of a sand cone per m^3 is IDR 120,000.00, and so on.

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Table 3. Tower Crane Rental Price Data

No C	Description Bla	Sat	Volume	Unit Price	Total
1	Mob Demob Heavy Equipment dan Erection	ls	1	IDR 297.000.000,00	IDR 297.000.000,00
2	Tower Crane 1	bln	6	IDR 69.841.666,67	IDR 419.050.000,00
3	Cost Of Foundation and Anchors	ls	1	IDR 125.000.000,00	IDR 125.000.000,00
4	PLN electricity costs	bln	6	IDR 15.000.000,00	IDR 90.000.000,00
5	Operator Fee (2 Person)	bln	6	IDR 17.000.000,00	IDR 102.000.000,00
6	Tool Insurance Costs	ls	1	IDR 2.500.000,00	IDR 2.500.000,00
7	Disnaker Licensing Fees	ls	1	IDR 10.000.000,00	IDR 10.000.000,00
		6 Months Fee			IDR 1.045.550.000,02
		Total Monthly Cost			IDR 174.258.333,34
		Total Cost Per Day			IDR 6.223.511,90

Source: Flatworker Industry Batang I Project Data

Based on the table above, it can be seen that each unit price of Bla varies depending on the volume and price per unit. For example, Anchors every 1s with a total volume of 6 and a price per unit of IDR 125,000,000.00, the total cost incurred is IDR 120,000.00, and so on.

Table 4. Data on Equipment Rental Prices and PCH

No D	Description Tool	Sat	Volume	Unit Price
1	Standard 1.8 meter	Bh		IDR 17.500,00
2	Standard 0.8 meter	Bh		IDR 17.400,00
3	Jack Base	Bh		IDR 10.000,00
4	U Head Jack	Bh		IDR 10.200,00
5	Suri suri Double	Bh		IDR 12.600,00
6	Siku balok	Bh		IDR 9.200,00
7	Horizontal Ledger	Bh		IDR 11.200,00
8	Primary Beam	Bh		IDR 7.600,00
9	Bucket cor	bln		IDR 2.500.000,00
10	Vibrator	bln		IDR 5.000.000, 00
11	Concrete pump	bln		IDR 50.750.000,00
12	Bar Bander	bln		IDR 6.500.000,00
13	Bar Cutter	bln		IDR 6.500.000,00

Source: Flatworker Industry Batang I Project Data

Based on the table above, it can be seen that the unit price of each tool is different. For example, the standard unit price of 1.8 meters per Bh is IDR 17,500.00,

1. Price Recapitulation Analysis of Precast Half Slab Plates Method

The building structure of the floor slabs on the Flats is designed with a length of 64.8 meters, a width of 22.8 meters, a thickness of 125 mm slab (70 mm precast half slab and 55 mm topping), and 250 mm x 450 mm beam supports. With the type of precast half slab, namely 17 types.

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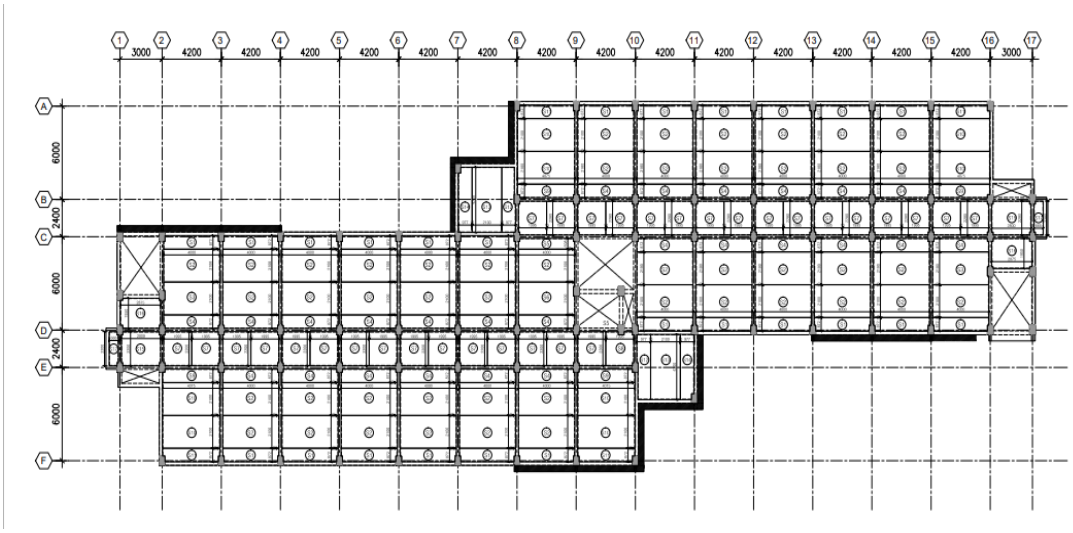

Source: Shop Drawing Flats Workers Industry Batang I

Figure 2. Half Slab Plate Plan

The structure of the floor slabs on the flats is designed with a length of 64.8 meters, a width of 22.8 meters, a thickness of 125 mm (70 mm precast half slab and 55 mm topping), and 250 mm x 450 mm beam supports. With precast half slab types, namely 17 types.

Table 5. Various Types of Half-Slab Precast Plates

No	Width (b)	Length (L)	Thickness (h)	Area	Volume
S1	892	4000	70	3568000	249760000
S2	2100	4000	70	8400000	588000000
S3	2100	4000	70	8400000	588000000
S4	882	4000	70	3528000	246960000
S5	718	4000	70	2872000	201040000
S6	2100	4000	70	8400000	588000000
S7	2200	2000	70	4400000	308000000
S8	2200	2000	70	4400000	308000000
S9	882	4075	70	3594150	251590500
S10	2100	4075	70	8557500	599025000
S11	892	4075	70	3634900	254443000
S12	4200	987	70	4145400	290178000
S13	4200	2100	70	8820000	617400000
S14	4200	988	70	4149600	290472000
S15	2200	2800	70	6160000	431200000
S16	1950	2875	70	5606250	392437500
S17	2200	666	70	1465200	102564000

Source: Project Data (Units in mm)

Then the results for the recapitulation of plate prices with the precast half slab method are as follows:

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Table 6. Cost Recapitulation of the Half Slab Precast Method

No	Description	Unit	Unit Price	Coefficient	Total (Price x Coefficient)	Total
1	1 Floor Half Slab (Typical)					
	Wages					
	Reinforcing	kg	IDR 850,00	1006,53	IDR 855.550,50	
	Wiremesh Enhancement	kg	IDR 645,00	13332,83	IDR 8. 599.675,35	
	Casting	m^3	IDR 36.000,00	114,99	IDR 4.139.640,00	IDR 13.594.865,85
	Materials					
	Readymix concrete K350 (FC 30)	m^3	IDR 786.800,00	114,99	IDR 90.474.132,00	
	Steel Bar	kg	IDR 8.550,00	1006,53	IDR 8.605.831,50	
	Wiremesh Iron M8-150 (threaded)	kg	IDR 9.550,00	13332,83	IDR 127.328.526,50	
	Hollow Metal 100	stem	IDR 292.000,00	18	IDR 5.256.000,00	
	Hollow Iron 50	stem	IDR 252.000,00	210	IDR 52.920.000,00	
	Multiplex 9 mm	m^2	IDR 110.000.00	297,68	IDR 32.744.800,00	IDR 317.329.290,00
	Tool					
	Tower Crane	bln	IDR 174.258.333,34	1	IDR 174.258.333,34	
	Bander Bar	bln	IDR 6.500.000,00	1	IDR 6.500.000,00	
	Bar Cutter	bln	IDR 6.500.000,00	1	IDR 6.500.000,00	
	Bucket Cor	bln	IDR 2.500.000,00	1	IDR 2.500.000,00	
	Vibrator	bln	IDR 5.000.000,00	1	IDR 5.000.000,00	
	Standard 1.8 meter	Bh	IDR 17.500,00	944	IDR 16.520.000,00	
	Standard 0.8 meter	Bh	IDR 17.400,00	944	IDR 16.425.600,00	
	Jack Base	Bh	IDR 10.000,00	944	IDR 9.440.000,00	
	U Head Jack	Bh	IDR 10.200,00	944	IDR 9.628.000,00	
	Suri Suri Double	Bh	IDR 12.600,00	373	IDR 4.699.800,00	
	Beam Elbow	Bh	IDR 9.200,00	676	IDR 6.219.200,00	
	Horizontal Ledger	Bh	IDR 11.200,00	1888	IDR 21.145.600,00	
	Primary Beam	Bh	IDR 7.600,00	612	IDR 4.651.200,00	IDR 283,488.533,34
			Total			IDR 614.412689,19

Source: Flatworker Industry Batang I Project Data

For a total wage of IDR 13,594,865.85, materials and materials needed IDR 317,329,290.00, and tools required IDR 283,488,533.34, so the total cost for floor work with the Half Slab precast method is IDR 614,412,689.19.

2. Work Price Recapitulation Analysis for the Conventional Plate Method

The dimensions for conventional slabs are the same as those for the precast half slab method, without distinguishing dimensions, namely 64.8 meters long, 22.8 meters wide, and 125 mm thick.

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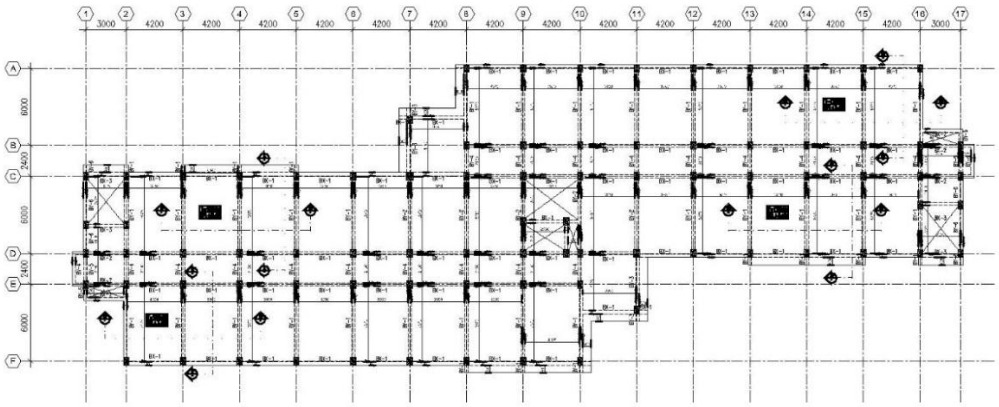

Source: Processed Data

Figure 3. Plan of the Conventional Plate

Table 7. Conventional Method Plate Fee Recapitulation

No	Description	Unit	Unit Price	Coefficient	Total (Price x Coefficient)	Total
1	1 Floor Work					
	wages					
	Wiremesh enhancement	kg	IDR 645,00	15941,82	IDR 10.282.473,90	
	Casting	m^3	IDR 36.000,00	131,748	IDR 4.742.928,00	IDR 15.026.401,90
	Materials					
	Beton readymix K350 (FC 30)	m^3	IDR 786.800,00	131,748	IDR 103.659.326,40	
	Besi Wiremesh M8-150 (ulir)	kg	IDR 9.550,00	15941,82	IDR 152.244.381,00	
	Multiplek 9 mm	m^2	IDR 110.000,00	1056,76	IDR 116.243.600,00	IDR 372.147.307,40
	Tool					
	Tower Crane	bln	IDR 174.258.333,34	1	IDR 174.258.333,34	
	Bander Bar	bln	IDR 6.500.000,00	1	IDR 6.500.000,00	
	Bar Cutter	bln	IDR 6.500.000,00	1	IDR 6.500.000,00	
	Bucket Cor	bln	IDR 2.500.000,00	1	IDR 2.500.000,00	
	Vibrator	bln	IDR 5.000.000,00	1	IDR 5.000.000,00	
	Standard 1.8 meter	Bh	IDR 17.500,00	944	IDR 16.520.000,00	
	Standard 0.8 meter	Bh	IDR 17.400,00	944	IDR 16.425.600,00	
	Jack Base	Bh	IDR 10.000,00	944	IDR 9.440.000,00	
	U Head Jack	Bh	IDR 10.200,00	944	IDR 9.628.800,00	
	Suri Suri Double	Bh	IDR 12.600,00	373	IDR 4.699.800,00	
	Beam Elbow	Bh	IDR 9.200,00	676	IDR 6.219.200,00	
	Horizontal Ledger	Bh	IDR 11.200,00	1888	IDR 21.145.600,00	
	Primary Beam	Bh	IDR 7.600,00	612	IDR 4.651.200,00	IDR 283.488.533,34
			Total			IDR 670.661.242,64

Source: Flatworker Industry Batang I Project Data

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For a total wage of IDR 15,025,401.90, the need for materials and materials is IDR 372,147,307.40, and the need for tools is IDR 283,488,533.34, so the total cost for floor work with the Conventional method is IDR 670,661,242.64.

There is a relationship between figure 3 and table 7, namely if figure 3 explains the floor area while table 7 explains the material requirements for wages for each floor. So figure 3 and table 7 explain how broad each base is and what is needed to construct one floor regarding wages, materials, and tools.

3. Work Time Analysis of Half Slab Precast Plates

Time analysis for calculating precast half slab work time estimates the time needed for each work item based on work volume and productivity.

Table 8. Recapitulation of Total Time of Slab Precast Half Slab Method

No	Type of Work	Time
1	Half Slab Manufacturing Work	2 day
2	Wiremesh Topping Floor Reinforcement	2.35 day
3	Scaffolding Work	0.46 day
4	Installation of Precast Half Slabs	0.88 day
5	Floor Plate Topping Casting	0.14 day
	Total	5,83 day

Source: Actual Calculation

Based on the table above, it can be concluded that the total time required in the precast half slab method is 5.83 days. This amount results from the half slab manufacturing work, floor topping wire-mesh reinforcement, scaffolding work, installation of half slab precast, and casting of floor plate toppings.

4. Analysis of Conventional Plate Working Time

Time analysis for conventional plate work, namely calculating the time for each job based on work volume and productivity.

Table 9. Recapitulation of the total time of conventional method plate work

No	Type of Work	Time
1	PCH Scaffolding Work	0.46 day
2	Formwork Work	0.13 day
3	Redemption Work	5.31 day
4	Floor Plate Casting	0.28 day
	Total	6,18 day

Source: Actual Calculation

Based on the above table, the total time required in conventional method plate work is 6.18 days. This amount results from the sum of the PCH scaffolding work, formwork work, ironing work, and casting of floor slabs.

5. Construction Calculations

For the removal of slabs from the mold according to SNI concrete standards, seven days (30% fc strength), but in the world of increasingly advanced construction, there is a need for acceleration, given the many requirements and limited time in the Project. So that the half slab is removed after the concrete has aged 24 hours or one day [20].

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For the lifting example, the half slab type is taken, which has the most significant dimension, namely with the data:

Half slab width	(Lx)	b	=	2100				mm		
Half slab length	(Ly)	L	=	4200				mm		
Half slab thickness		h	=	70				mm		
Thick cast insitu topping		h1	=	55				mm		
Concrete covers		p	=	20				mm		
Flexible reinforcement			=	D	8	-	150	mm		
Shrinking reinforcement			=	D	8	-	150	mm		
As			=	334.93				mm^2		
Concrete quality (1 day)		K	=	994.835	kg/cm^2		f'c	=	8.26	Mpa
Steel quality		fy	=	500				Mpa		
Specific gravity of concrete		γc	=	2400				kg/m^3		
Effective height of the wall		d	=	38.00				mm		
Coefficient of shock load		k	=	2						
Steel's modulus of elasticity		Es	=	210000				Mpa		
Appointment age		t	=	24				Hour		
Number of handling loops		n	=	8				Pcs		
Steel quality handling loop		fy	=	420				Mpa		

Figure 4. Data Dimension Half Slab

a. Loading

Dead load (DL) =(t)×γc=0.7×2400=168 kg/m2
Shock load during lifting and installation (especially slab slabs)
=2×(DL)=2×168=336 kg/m2
Live Load (LL)=0 kg/m2
Ultimate Load (Wu) =1.2DL+1.6LL=1.2(168)+1.6(0)=403.2 kg/m2
Load for 1 m of sheet width (qu) =(Wu)×1=403.2×1=403.2 kg/m2or 4.032 N/mm

b. The moment that happened

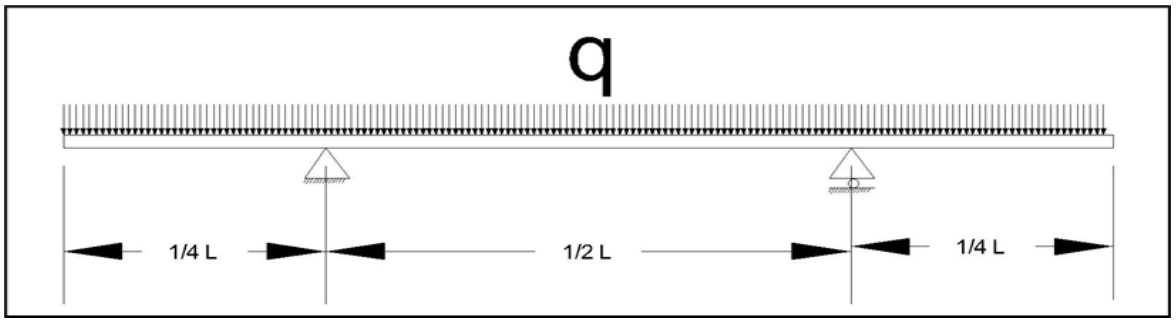

Figure 5. The Moment That Occurs During Lifting

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Equation 1

$$Mu = Mmax$$

$$Mmax = 175{,}0329\ kgm = 1.750.329{,}00\ Nmm \text{.....(1)}$$

c. Moment Capacity (Mn)

Equation 2

$$\text{rb} = \frac{0{,}85 \times f'c \times b}{fy} \times \frac{600}{600+fy} = \frac{0{,}85 \times 8{,}26 \times 0{,}85}{500} \times \frac{600}{600+500} = 0.00651$$

$$\text{rmax} = 75\% \times rb = 75\% \times 0{,}00651 = 0{,}00488$$

$$\text{rmin} = \frac{1{,}4}{fy} = \frac{1{,}4}{500} = 0{,}00280$$

$$\text{r ada} = \frac{As}{b \times d} = \frac{334{,}93}{2100 \times 38{,}00} = 0{,}00420$$

$$T = As \times fy = 334{,}93 \times 500 = 167466{,}67\ N$$

$$X = \frac{T}{\theta \times 0{,}85 \times fc \times b} = \frac{167466{,}67}{0{,}8 \times 0{,}85 \times 8{,}26 \times 2100} = 14{,}20\ mm$$

$$Mn = T \times (d - 0{,}5^{*}X) = 167466{,}67 \times (38{,}00 - 0{,}5^{*}14{,}20)$$

$$= 5.174.494{,}00\ Nmm \text{.....(2)}$$

(Mn) > (Mu) = OK

d. Concrete stress that occurs during lifting

$$Cb = 0{,}5 \times t = 0{,}5 \times 70 = 35$$

$$I = \frac{1}{12} \times b \times h^3 = \frac{1}{12} \times 1000 \times 70^3 = 28.583.333{,}33\ mm^4$$

$$\sigma cm = \frac{Mmax \times Cb}{I} = \frac{1.750.359 \times 35}{28.583.333{,}33} = 2{,}14\ Mpa = 21{,}4\ kg/cm^2$$

e. Minimum concrete quality at lifting

$$\sigma rm = \sigma cm$$

$$fcr = \left(\frac{\sigma rm}{0{,}7}\right)^2 = \left(\frac{2.14}{0{,}7}\right)^2 = 9{,}37\ Mpa = 93{,}7\ kg/cm^2$$

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f. Concrete quality at age (t) hours

$$t = 24\ hours$$

$$fc(t) = 3{,}057(24) + 11{,}448 = 84{,}816\ kg/cm^2$$

g. Deflection At Lifting

Modulus of Elasticity of Concrete = Ec

$$Ec = 4700\sqrt{fc'} = 4700\sqrt{2{,}14} = 6.880{,}74\ Mpa$$

Equation 1

$$d\ occurs = \frac{0{,}586 \times L}{180} = \frac{0{,}586 \times 4200}{180} = 13{,}67\ mm \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Equation 2

$$d\ permit = \frac{5 \times qu \times (A2)^4}{384 \times Ec \times I} = \frac{5 \times 4{,}032 \times (2100)^4}{384 \times 6.880{,}74 \times 28.583.333{,}33} = 5{,}19\ mm \ldots\ldots\ldots\ldots\ldots (2)$$

d occurs < d permit = **Safe Deflection.**

After obtaining these results, this shows that the strength of precast concrete can be said to be safe.

4. Conclusion and Suggestion

4.1 Conclusion

Based on the analysis carried out in the Final Project "Analysis of the Half Slab Precast Method in the Construction of Flats for Batang I Industrial Workers", namely in terms of cost and time, it can be concluded that the half slab precast method is more profitable because it is faster than the conventional method which only requires 5.83 days, while the conventional method takes 6.18 days. Then in terms of cost it is also cheaper because the precast half slab method only costs IDR 614,412,689.19 while the conventional method costs IDR 670,661,242.64. In terms of construction, the half slab method is safe to apply in the field with evidence that the precast half slab can be lifted within 1 day and based on the calculation of the moment capacity (Mn) at the time of lifting, the result is = 5,174,494.00 Nmm greater than (Mu) = 1,750 .329.00 Nmm and based on the calculation of the deflection that occurs when lifting is carried out, d = 5.19 mm less than the allowable d = 13.67 mm.

4.2 Suggestion

Based on the analysis carried out in the Final Project "Analysis of the Half Slab Precast Method in the Construction of Flats of Industrial Workers in Batang I" namely in terms of cost and time, the suggestions that the author can give are:

1. The use of the precast half slab method is very possible to implement and apply to today's fast-paced projects, but for work effectiveness and efficiency it is necessary to pay attention to determining the type of half slab which is more uniform, not too many types.
2. Continue to think innovatively as the world of construction progresses, because it is possible that the knowledge we apply today will no longer be applicable in the future.

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References

[1] T. H. Wijaksono, O., Tistogondo, J., & Bagio, "Analisis Perbandingan Efisiensi Waktu Dan Biaya Antara Metode Konvensional Slab, Precast Half Slab Dan Precast Full Slab Pada Proyek Bangunan Hotel Bertingkat Di Surabaya.," *Pros. Semnastek.*, 2018.

[2] PT Pembangunan Perumahan (Persero) Tbk., "Work Methode Statement Proyek Rumah Susun Pekerja Industri Batang I," 2022.

[3] V. Aprilia, "Analisis Perbandingan Sistem Struktur Pelat Konvensional Dan Half Slab Ditinjau Dari Segi Biaya Dan Waktu," 2021.

[4] D. Aprisandi, "Analisis Biaya Dan Waktu Metode Half Slab Dalam Pembangunan Proyek Konstruksi.," *J. Lingkung. Dan Sumberd. Alam (JURNALIS), 1(1), 51-61.*, 2018.

[5] R. Rahman, "Analisis Perbandingan Biaya Pelat Lantai Antara Metode Precast Half Slab Dan Metode Konvensional (Cost Comparison Analysis Between Precast Half Slab Method And Conventional Method)(Studi Kasus: Proyek Pembangunan Pasar Prambanan).," 2019.

[6] PT Pembangunan Perumahan (Persero) Tbk., "Precast Half Slab. Jakarta,"

[7] D. H. Wisanggeni, "Perbandingan Sistem Pelat Konvensional dan Precast Half Slab Ditinjau Dari Segi Waktu dan Biaya Pada Proyek My Tower Apartement Surabaya," 2017.

[8] S. Edhi, "Analisa Perbandingan Waktu Dan Biaya Metode Konvensional Dengan Flat Slab Struktur Pelat Lantai Apartemen Grand Dharmahusada Lagoon Surabaya.," 2019.

[9] S. Dewi, I. A., & Sukobar, "Perhitungan Waktu dan Biaya Pelaksanaan Proyek Pembangunan Apartemen Solo Urbana Residence Tower D dengan Metode Half Slab.," *J. Tek. ITS, 11(2), C35-C41.*, 2022.

[10] N. K. Saragi, T. E., & Zalukhu, "Analisa Perbandingan Pelaksanaan Struktur Pelat Lantai Metode Konvensional, Boundeck Dan Precast Full Slab Ditinjau Dari Segi Waktu Dan Biaya Pada Proyek Pembangunan Gedung Gbkp Tanah Merah Binjai.," *J. Constr. 1(2), 38-52.*, 2022.

[11] U. Suaiba, "Analisa Perbandingan Sistem Half Slab Dan Plat Konvensional Ditinjau Dari Segi Waktu Dan Biaya Pada Proyek Apartemen Gunawangsa Tidar Surabaya.," *Elem. J. Tek. Sipil, 1(1), 1-9.*, 2019.

[12] M. A. Trijeti, Farid Dwi Atmawan, "Time And Cost Comparison Of Conventional And Alternative Plate Hollow Slab, Halfslab And Metaldeck," *Int. J. Sci. Technol. Res. Vol. 7, ISSUE 06*, 2018.

[13] A. Juara, "Jadi Pengaruh Kuat Tekan Beton Dengan Limbah Biji Salak Kering Sebagai Pengganti Sebagian Agregat Kasar.," *Teras, 12(1), 19-28.*, 2022.

[14] F. Rochman, T., Rasidi, N., & Purnomo, "The Flexural Performance Of Lightweight Foamed Precast Concrete Slabs: Experimental And Analysis.," *Geomate Journal, 20(77), 24-32.*, 2021.

[15] N. Oktavianto, D., & Rochmah, "Perencanaan Struktur Gedung Kantor Otoritas Jasa Keuangan (Ojk) Kawasan Regional 4 Dengan Metode Beton Pracetak.," *Padur. J. Tek. Sipil Univ. Warmadewa, 11(2), 229-239.*, 2022.

[16] I. Rakhmawati, A. N., Devia, Y. P., & Wijatmiko, "Life Cycle Assessment (LCA) Analysis Of Concrete Slab Construction For Estimating The Environmental Impact.," *Rekayasa Sipil, 14(3), 232-237,* 2020.

[17] M. Kurniawan, "Perbandingan Analisis Struktur dan Efisiensi Biaya Struktur Slab on Pile Menggunakan Metode Precast Half-Slab dan Metode Monolite, Serta Kombinasi Mutu Beton Slab on Pile (Studi Kasus Jembatan Perawang). Jurnal Saintis, 16(1), 46-62.)," 2016.

[18] M. ARI N U G RAH A N U RJA MAN, *Basic Precast System And Precast Outlook*

ISSN (*Online*) 2620-7222
ISSN (*Print*) 2503-2399

In Seismic Region Of Indonesia. 2018.
[19] W. (2022). Riyadi, I., Handayani, E., & Dony, "Analisa Perbandingan Sistem Pelat Konvensional dengan Sistem Precast Half Slab dalam Segi Waktu dan Biaya.," *J. Civronlit Unbari, 7(2), 63-69.*, 2019.
[20] Badan Standarisasi Nasional., *Persyaratan Beton Struktural untuk Bangunan Gedung (SNI-2847-2019).Jakarta.* 2019.