

COMPARATIVE ANALYSIS OF PRECAST HALF SLAB COST BUDGET PLANS WITH CONVENTIONAL CONCRETE PLATES

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Abstract. *The development of construction methods used in construction has progressed from year to year and in planning the construction of a building it is necessary to select several construction methods. Among them are casting methods that can be done conventionally in a more modern and practical way, namely by using precast. In this research, the floor slab construction method is planned using the conventional floor slab method and the precast half slab method in the Kajen Regional Hospital construction project. The purpose of this research is to analyze the cost efficiency and construction time between the conventional floor slab method and the precast half slab method. The results of the comparison analysis of the conventional floor slab method require a cost of Rp797,269,777.81 with an implementation time of 64 days while the precast half slab method requires a cost of Rp1,470,907,469.89 with an implementation time of 72 days.*

Keywords: *Conventional Plate, Precast Half Slab, Cost, Time.*

1. Introduction

The development of methods used in the construction sector has progressed from year to year, so that there are several construction methods that can be chosen when planning a construction building. One of them is the casting method which can be done conventionally (cast in situ) with a more modern and practical method, namely by using precast [1].

A floor plate is a thin structure made of reinforced concrete with a plane that is horizontal and the load acts perpendicular to the plane of the structure so that in buildings this plate functions as a diaphragm or horizontal stiffening element which is very useful for supporting the rigidity of the portal beam [2]. The half slab method is a system for working on floor slabs by dividing the slab into 2 parts. Cast in place for the top of the plate and precast for the bottom of the plate. The reinforcement in cast in place concrete is the top reinforcement of the floor plate and the reinforcement in the precast plate is the reinforcement under the floor plate according to the structural design [3]

In this case the research was carried out on the implementation of the Kajen Regional Hospital construction project which is located on Jalan Raya Karangasari Karanganyar, Pekalongan Regency, Central Java. In implementing this project, calculations were planned using conventional methods and the precast half slab method.

The formulation of the problem that will be discussed in this research is "What is the SWOT analysis in using precast half slab and conventional?". The objectives that researchers want

through this research are “understand the SWOT analysis in the use of precast half slab and conventional”.

2. Research Methods

2.1. Research Sites

This research only focuses on the upper structural work of buildings, namely conventional floor slabs and precast half slabs. The location of this research is on Jl. Raya Karang Sari Karanganyar, Pekalongan Regency, Central Java.

2.2. Research Methods

The method used in this research is a quantitative comparative method. Quantitative comparative method is this type of research using quantitative data to compare groups or variables on a measurable scale.

2.3. SWOT Analysis

SWOT analysis is a strategy planning technique or method that aims to evaluate the strengths, weaknesses, opportunities and threats of a company in a project (Humphrey in Sasoko & Mahrudi, 2023 [4]). SWOT analysis is a method for explaining conditions and evaluating project problems based on internal and external factors. SWOT analysis consists of four factors, namely:

1. Strength

Strength factors in project development institutions are special competition or other advantages that result in added value or comparative advantage in project development.

2. Weakness

Weaknesses are normal in everything, but the most important thing is how as a policy maker in project development you can minimize these weaknesses or even turn these weaknesses into advantages that other project developments do not have.

3. Opportunities

Opportunity is a favorable external environmental condition that even becomes a formality and institution for project development.

4. Threats

Threats are the opposite of opportunities, threats include environmental factors that are unfavorable for project development. If a threat is not addressed, it will become a barrier or obstacle to the progress and role in a development project.

3. Results and Discussion

3.1. Method of Collecting Data

For the data collection stage, the researcher submitted a request to request the data needed for the research in the form of primary data consisting of interviews, field surveys, and documentation as well as secondary data consisting of working drawings, cost budget plans, unit price analysis.

3.2. Data Analysis

The researchers then analyzed the collected data including calculating the volume of work for the conventional method and the precast half slab method, calculating the cost of work for the conventional method and the precast half slab method, and calculating the time for the conventional method and the precast half slab method.

3.3. Building Data

Kajen Hospital Construction Project located on Jl. Raya Karangasari Karanganyar, Pekalongan Regency, Central Java, with a planned 4 floors and the building area of each floor is 1,395.81 m².

3.4. Analysis of The Volume of Work

Work Volume Analysis is calculated based on work plan drawings for conventional and precast half slab methods. The conventional method volume analysis calculated is in the form of formwork work, steel work and concrete casting work, while the precast half slab method volume analysis calculated is panel formwork work, panel steel work, panel concrete casting work, support pipe installation work, erection and installation work, , overtopping iron work, and overtopping concrete casting work. The results of conventional work volume calculations can be seen in table 1 and the precast half slab work volume in table 2.

Based on the table above, the recapitulation results for the volume of conventional floor slab work are obtained, namely the formwork volume is 1,717.96 m², the reinforcement volume is 2,835.96 kg, and the concrete volume is 206.16 m³.

Based on the table above, the recapitulation results of the volume of precast half slab work are obtained, namely the volume of precast half slab formwork is 1,872.30 m², the volume of precast half slab reinforcement is 1,872.30 m², the volume of precast half slab concrete is 131.06 m³, the volume of overtopping is 1,872 .30 m², the volume of overtopping concrete is 93.62 m³, the need for support pipes is 1379 sets, the erection and installation of panels is 1379 pieces.

Table2. Recapitulation of conventional work volume analysis

No	Job Description	Volume	Unit
1	2 nd floor formwork	628,50	m ²
2	3 rd floor formwork	544,73	m ²
3	4 th floor formwork	544,73	m ²
4	2 nd floor iron steel work	1.100,22	kg
5	3 rd floor iron steel work	867,87	kg
6	4 th floor iron steel work	867,87	kg
7	2 nd floor concrete casting work	75,42	m ³
8	3 rd floor concrete casting work	65,37	m ³
9	4 th floor concrete casting work	65,37	m ³

Table3. recapitulation of precast half slab work volume analysis

No	Job Description	Volume	Unit
1	Panel formwork work	1.872,30	m ²
2	Panel iron steel work	1.872,30	m ²
3	concrete panel casting work	131,06	m ³
4	support pipe installation work	1.379	set
5	Panel erection work	1.379	bh
6	Iron steel work for overtopping	1.872,30	m ²
7	Concrete panel casting for overtopping	93,62	m ³

3.5. Job Cost Analysis

Work cost analysis is calculated based on unit prices referring to SNI 7394:2008, HSP Pekalongan Regency, and the results of your own analysis. The results of conventional work cost calculations can be seen in table 4 and the cost of prepainted half slab work in table 5.

Based on the results of the table above, the total cost of conventional floor plate work is obtained, namely conventional floor plate formwork work on the 2nd floor amounting to IDR 189,600,783.43, the 3rd floor amounting to IDR 164,330,166.81, and the 4th floor amounting to IDR 164,330,166.81. So the

Table4. Recapitulation of Conventional Cost Analysis

No	Job Description	Price (IDR)
1	2 nd floor formwork	189.600.783,43
2	3 rd floor formwork	164.330.166,81
3	4 th floor formwork	164.330.166,81
4	2 nd floor iron steel work	16.816.916,20
5	3 rd floor iron steel work	13.265.329,67
6	4 th floor iron steel work	13.265.329,67
7	2 nd floor concrete casting work	86.214.312,42
8	3 rd floor concrete casting work	74.723.385,90
9	4 th floor concrete casting work	74.723.385,90

Table5. Recapitulation of Half Slab Precast Cost Analysis

No	Job Description	Price (IDR)
1	Panel formwork work	503.376.048,24
2	Panel iron steel work	106.730.739,40
3	concrete panel casting work	123.238.289,79
4	support pipe installation work	64.196.297,41
5	Panel erection work	479.450.720,00
6	Iron steel work for overtopping	106.730.739,40
7	Concrete panel casting for overtopping	87.184.812,66

total cost of conventional floor plate formwork work is IDR 797,269,777.81. The work of repairing conventional floor slabs on the 2nd floor amounted to IDR 16,616,916.20, the 3rd floor amounted to IDR 13,265,329.67, and the 4th floor amounted to IDR 13,265,329.67. So the total cost of repairing conventional floor slabs is IDR 43,347,575.54. The conventional floor slab concrete casting work on the 2nd floor amounted to IDR 86,214,313.42, the 3rd floor amounted to IDR 74,723,385.90, and the 4th floor amounted to IDR 74,723,385.90. So the total cost of repairing conventional floor slabs is IDR 235,661,777.81. From the results of the total work costs, a recapitulation of the cost of conventional floor slabs was IDR 797,269,777.81.

Based on the results of the table above, the total cost of the precast half slab work is obtained, namely the cost of the precast half slab formwork work is IDR 503,376,048.24, the cost of the precast half slab M7 wire mesh work is IDR 106,730,739.40, the cost of the precast half slab concrete casting work is IDR 106,730,739.40. IDR 123,238,289.79, the cost of installation of support pipes is IDR 64,196,297.41, the cost of erection and installation of precast half slabs is IDR 479,450,720.00, the cost of work on reinforcing wiremesh overtopping is IDR 106,730,739.40, and the cost of work overtopping casting amounting to IDR 87,184,812.66. So we get a recapitulation of the cost of the precast half slab work of IDR 1,470,907,646.89.

3.6. Job Time Analysis

Job time analysis is the time determined to do a job. Below are time calculations from both methods, namely conventional and precast half slab, each of which has different time calculation components.

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Table6. Recapitulation of Conventional Time Analysis

No	Job Description	Duration (day)
1	Formwork work	54,23
2	Iron Steel Work	4,82
3	Concrete Casting Work	4,36

Table7. Recapitulation of Precast half slab Time Analysis

No	Job Description	Duration (day)
1	Panel Fabrication work	23
2	Support pipe installation work	5,75
3	Panel erection work	32,26
4	Iron steel work for overtopping	7,81
5	Concrete panel casting for overtopping	2,68

Based on the results of the table above, we get a recapitulation of the work time for conventional floor slabs, namely formwork work is 54.23 days, steel work is 4.82 days, and casting work is 4.36 days. So you will get a total duration of conventional floor slab work of 63.41 days or rounded up to 64 days.

Based on the results of the table above, a summary of the precast half slab work time is obtained, namely precast half slab fabrication work for 23 days, support pipe installation work for 5.75 days, erection and installation work for precast half slabs for 32.26 days, overtopping work for 7, 81 days, and overtopping concrete casting work for 2.68 days. So the total duration of the precast half slab work will be 72 days.

3.7. Comparative Analysis of Job Costs

Based on cost analysis calculations, it can be concluded that conventional slabs cost IDR 797,269,777.81, while precast half slabs cost IDR 1,470,907,469.89. Efficiency in terms of cost is cheaper using conventional plates because it has a cost difference of IDR 673,637,869.08.

3.8. Comparative Analysis of Work Time

Based on the results of the table above, a summary of the precast half slab work time is obtained,

Table1. Comparative analysis

Conventional	Precast Half Slab
1. Panel formwork work	1. Panel formwork work
2. Panel iron steel work	2. Panel iron steel work
3. Concrete panel casting work	3. Concrete panel casting
	4. Support pipe installation work
	5. Panel erection work
	6. Iron steel work for overtopping
	7. Concrete panel casting for overtopping

namely precast half slab fabrication work for 23 days, support pipe installation work for 5.75 days, erection and installation work for precast half slabs for 32.26 days, overtopping work for 7, 81 days, and overtopping concrete casting work for 2.68 days. So the total duration of the precast half slab work will be 72 days.

3.9. Comparative Analysis

The things that will be analyzed as a comparison stage in terms of cost and time for conventional and precast methods are:

3.10. SWOT Analysis

Table9. Precast SWOT Analysis

Strength	Weakness
<ol style="list-style-type: none"> 1. Can reduce project implementation time because it allows projects to carry out overlapping work. 2. The quality of the concrete is guaranteed to be good because its manufacture is supervised and maintained according to standards. 3. The construction process is not hampered by weather, because the concrete used is precast and can be installed directly at the construction site. 	<ol style="list-style-type: none"> 1. Requires additional costs such as erection costs and installation of precast panels at the location to be installed. 2. Requires a large area of land for manufacturing and storing precast concrete. 3. The shape of the precast is quite difficult to make because it has to be made according to type (not flexible).
Opporrtunity	Threat
<ol style="list-style-type: none"> 1. With increasingly sophisticated technology, precast concrete products can still be developed further in terms of shape, span, etc. 2. During the rainy season, precast concrete can be an effective solution for carrying out concrete work. 3. Precast concrete can be produced in a controlled factory environment, thereby minimizing waste and emissions on construction sites. 	<ol style="list-style-type: none"> 1. Coordinating the casting process is more difficult, because the number of work items is smaller and requires experienced experts. 2. More heavy equipment is used, such as cranes for erecting and installing precast panels. 3. The uncertain location of the project makes transportation and mobilization impossible in a narrow project location.

The analysis results obtained for the conventional floor slab and precast half slab work for the Kajen Regional Hospital construction project resulted in a SWOT analysis which can be seen in the following table 8:

Based on the table above, it is found that the benefits obtained from using the precast concrete method as a substitute for conventional concrete is the right choice.

4. Conclusion

Table8. Conventional SWOT Analysis

Strength	Weakness
<ol style="list-style-type: none"> 1. Can be done in narrow areas. 2. Work and supervision are more controlled. 3. Relatively easy and general calculations. 	<ol style="list-style-type: none"> 1. Work is carried out sequentially and is related to other work. 2. Use of more human resources or labor.
Opporrtunity	Threat
<ol style="list-style-type: none"> 1. Coordination of casting is easier, because the number of work items is smaller. 2. The heavy equipment used is simpler. 3. Ease of location access which can be done even in remote areas. 	<ol style="list-style-type: none"> 1. The manufacturing process is affected by the weather, for example rain will interfere with the casting process. 2. Conventional concrete production makes it difficult to monitor and maintain concrete quality.

From the results of the analysis of two methods, namely conventional floor slabs and precast half slabs, the following conclusions were obtained:

1. The conventional implementation method costs IDR 797,269,777.81, while the precast half slab implementation method costs IDR 1,470,907,469.89. The cost efficiency is cheaper using the conventional method because it has a cost difference of IDR 673,637,869.08 compared to precast half slab.
2. The conventional implementation method requires an implementation time of 64 days, while the precast half slab implementation method requires an implementation time of 72 days. Time efficiency is faster using the conventional method because it has a difference in implementation time of 8 days compared to precast half slab.
3. SWOT analysis shows that the efficiency of using precast concrete as a substitute for conventional concrete is the right choice. However, in this study the analysis results obtained from the precast half slab method were more expensive, because there were more work items, so it required more expensive costs and the implementation time was longer than the conventional slab method.

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