Cost Analysis of Pedestrian Bridge Floor Plate Method Hollow Core Slab Plate (Hcs) and Conventional Plate From The Implementation of Bridge Work Connecting Jakarta International Stadium

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Abstract

The development of the construction world is very fast, civil technology and its accompanying and innovation are growing, with the increasingly dense population, the demand for a product and services that are getting faster will also increase. The dense mobilization and narrowness of the land make the scope of construction smaller. This triggers relatively short and efficient construction demands. In the Jakarta international stadium development project, there are several work items including the construction of a bridge connecting the stadium specifically for the mobilization of spectators to and from the stadium. The method used is the Detailed Analysis method. This method uses data on each productivity of each work so that it can coefficient from the results of the analysis of the unit price of the work, with the final guidance to know the cost of each method both Precast and conventional methods. The results of the analysis parachuted that floor plates using conventional systems are cheaper to use than Precast plates. Obtained the total cost of Implementation for Conventional plates amounted to Rp. 3,256,890, and For Precast Plate Cost Rp. 4,206,456 with a percentage difference of 22,6%

Keywords
Detailed Analysis, Implementation Cost, Precast Plate, Conventional Plate

1. Introduction

The development of world construction is very fast, technology civil and the attendant and innovation increasingly growing, with a long increasingly dense population then the demand will be a product and service that is growing rapidly is also, of course, be further increased. Dense mobilization and the narrowness of the land make the scope of the construction is getting smaller. It is triggered demands the construction of which is relatively short and efficient

Concrete precast according to SNI 03-2847-2002 (SNI 7832, 2012) is the element or component of concrete without or with reinforcement were printed up in advance before it is assembled into a building. Precast concrete is no different from ordinary concrete, what makes it different is the method of manufacture. (Nurjannah, 2011) describes the Electoral system of concrete precast is because the system has several advantages compared with the system structure of concrete that is cast in place, namely:

- Implementation of the work in the field can be done more quickly more an easier to reduce the period of construction
- Implementation is fast so it can reduce the cost of construction.
- Controlling the quality of work is good for processing components frames done before installation (installation) as the structure of the building so that the quality of construction is guaranteed.
- Reducing material molding of the material timber to support the preservation of the environment.
- Reduce the use of scaffolding
- Reducing the number of workers in the field
- The condition of the pitch is more cleaner

Whereas Concrete cast in situ is the removal of a mixture of concrete liquid from the mixer to the place where the concrete will be cast namely formwork or reference to the structure that will be done, or concrete that is cast in place, with mold or reference that is installed in the location element of the structure of the building or buildings or infrastructure (Najano et al., 2016).

In the project development of Jakarta international stage, there are a few items of work such as the construction of a bridge connecting the stadium that specializes for the mobilization of the audience from and to stadion in the study, the author focuses the discussion on the structure of the plate floor, where the passage of time terdapat changes to the design of the plate floor of the, from flat floor conventionally be Plat floor Precast.
2. Methodology

Analysis of costs on a project requires analysis in each item of work that starts from the analysis of the material until the method implementation so that it can be a percentage of a job. Then from it to analyze it, the authors perform a method of analysis as follows:

1. Literature study
   Books, guidelines, scientific journals, and final assignments become references for authors to conduct data analysis.

2. Data processing techniques
   The data was obtained in the form of secondary data in the form of working drawings, work volume, and regulatory standards then analyzed on a worksheet.

   Analysis of the Directorate General of Highways Unit Price Analysis Guide No. 008BM2008 The following is Figure 2.1 research flow diagram.

3. Result and Discussion

3.1. Project Overview

1. In this research, the data used is data from the Ramp construction project connecting the Jakarta International Stadium, this project is a project owned by PT. JakPro is located in the Papango village, Tanjung Priok, North Jakarta. This project consists of many civil works, including the Connecting ramp work. In this study, the civil works carried out by contractors PT. X. This Ramp job has a contract value of 32,500,000,000.00,-
3.2. Conventional Floor Plate Implementation Method

![Flowchart of the stages of the Conventional Floor Plate Method](image)

Figure 2. Flowchart of the stages of the Conventional Floor Plate Method

3.3. Job Preparation Stage
1. Making and submitting shop drawings for each section of the concrete structure work.
2. Approval of materials to be used
3. Preparation of work area, materials and tools and work area.

3.4. Measurement Stage
1. Surveyors (Surveyors) using Theodolite take measurements and marking areas for placement points, dimensions (dimensions) and leveling of piers, sloof, columns, beams, floor plates, stairs and retaining walls.
2. The work of measuring and marking the area is carried out sequentially following the workflow of the concrete structure to be worked on.

3.5. Reinforcement Preparation Stage
1. The implementation of reinforcing steel fabrication requires a large enough place to put, cut the concrete and bend it so that it is following the approved drawings.
2. The quality and diameter of the concrete used for this project are adjusted to the working drawings and RKS.
3. Cut and shape the concrete iron to the size according to the working drawings.
4. Concrete iron frame using concrete wire.
5. Fabricated concrete is marked according to its placement, so as not to confuse or waste time when it is installed

3.6. Formwork Work Stage
1. Scaffolding is arranged in a row. Calculate the height of the scaffolding plate by adjusting the base jack and u-head jack.
2. On the u-head, wooden beams (girders) 6/12 are installed parallel to the direction of the cross brace and above the girders, girders are installed in the transverse direction.
3. Then install the plywood as the base plate. Also, attach the wall to the edge of the plate and then clamp it using an elbow. plywood is installed as tightly as possible, so that there are no cavities that can cause leakage during casting.
4. All formwork is tightly installed, preferably smeared with diesel as a lubricant so that the concrete does not stick to the formwork, to facilitate the demolition work and the formwork is still in a usable condition for the next work.
5. After the installation of the beam and plate formwork is considered complete, then check the level height on the beam and plate formwork using a water pass, if it is complete then the formwork for beams and plates is ready.

3.7. Reinforcement Stage
1. Plate reinforcement is carried out directly on the ready plate formwork. The reinforcing steel is lifted using a tower crane and installed on the plate formwork.
2. Assemble the iron with the lower reinforcement first, after completing the cross-assembly and tie it using concrete wire, then place the concrete decking between the lower reinforcement plate and the base plate formwork which will later function as a concrete blanket.
3. When finished, assemble the upper reinforcement using the D10-200 reinforcement (for the upper and lower reinforcement) and install the chicken leg reinforcement between the upper and lower reinforcement of the plate.

3.8. Conventional Slab Casting Stage
1. Conducting Job Mix Formula to determine the required mix composition so that the concrete quality is as expected.
2. All surfaces and locations of casting must be free from dirt and debris. After cleaning, flow the ready mix concrete to the concrete pump.
3. Concrete pump Ready mix concrete will be pumped and flowed to the structural elements to be cast.
4. Do raking so that the concrete can be spread evenly. After that, compaction is carried out using a concrete vibrator.

3.9. Curing
Concrete treatment (curing) is carried out when the concrete reaches the final set, where the concrete has hardened so that the formwork can be dismantled when the concrete has reached its age.

3.10. Metode Pelaksanaan Plat Hollow Core Slab

![Flowchart](image)

Figure 3. Flowchart stage method Plat floor Hollow Core Slab

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3.11. Distribution
1. Distribution
This HCS product is distributed from a factory located in Bogor (52 km distance).
2. Handling
is carried out at the time of unloading from the transport truck, stacking and lifting during installation.
3. Transportation
from the top of the truck, using lifting slings that meet the lifting capacity and stacked according to the technical instructions from the manufacturer.
4. Transportation
be done by using Tower Crane or using Mobile Crane, it is not allowed to lift using a manual method or Fork Lift.

3.12. Erection Hollow Core Slab
1. The Hollow Core Slab is transported by tronton truck to the project site, then the crane advances towards the tronton truck and the webbing sling is attached to the Hollow Core Slab and crane hook as shown below. Erection Hollow Core Slab uses a crane with a minimum capacity of 55 tons and a minimum safety factor of 1.15.
2. Hollow Core Slab is placed on top of the beam following the sequence of erection placement.
3. After the Hollow Core Slab is placed on the beam, remove the webbing sling from both sides of the Hollow Core Slab.
4. The crane returns to its original position for the next Hollow Core Slab erection.

3.13. Composite Reinforcement and Wire mass Installation
Composite reinforcement installation works for fastening between beams with Hollow Core Slab. At the same time to meet the needs of the moment beam. This reinforcement is placed in the gap between the beam and the Hollow Core Slab along the beam.
Reinforcement connectors using 8 mm diameter threaded iron. The placement of this reinforcement is installed on the Hollow Core Slab template and looking at the other Hollow Core Slabs, this reinforcement works as a binder between the Hollow Core Slabs.

3.14. Overtopping Casting Stage
In general, the overtopping casting process is almost the same as conventional, which is first checked by the engineer and a casting permit is signed by the supervisor, the thickness of this overtopping is 50 mm thick from the surface of the Hollow Core Slab. Here you can see the details of the overtopping casting.

3.15. Curing
Concrete treatment (curing) is carried out when the concrete reaches the final set, where the concrete has hardened so that the formwork can be dismantled when the concrete has reached its age.

3.16. Discussion
Following are the results of the analysis of each work between the conventional method and the Precast method.
From the results of the analysis of the conventional implementation method, the cost calculation is obtained by the formula:
"Total price = Coefficient x Unit Price".
The analysis is based on the price per 1 m3 of work

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<thead>
<tr>
<th>Table 1. Conventional Plate Cost Analysis</th>
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TOTAL HARGA PERKIRAAN: 2,960,808.80

C. PERALATAN
1. Peralatan                  | L01    | jam           | 3,0755     | 186,460.00           |
2. Peralatan                  | L02    | jam           | 1,0807     | 63,023.25            |
3. Peralatan                  | L03    | jam           | 1,0807     | 63,023.25            |
4. Peralatan                  | L04    | jam           | 1,0807     | 63,023.25            |
5. Peralatan                  | L05    | jam           | 1,0807     | 63,023.25            |
6. Peralatan                  | L06    | jam           | 1,0807     | 63,023.25            |
7. Peralatan                  | L07    | jam           | 1,0807     | 63,023.25            |

TOTAL HARGA PERKIRAAN: 2,281,751.00

D. BAHAN
1. Material                   | L01    | kg            | 49.47      | 2,960,808.80          |
2. Material                   | L02    | kg            | 2.7017     | 169,155.00            |
3. Material                   | L03    | kg            | 2.7017     | 169,155.00            |
4. Material                   | L04    | kg            | 2.7017     | 169,155.00            |
5. Material                   | L05    | kg            | 2.7017     | 169,155.00            |
6. Material                   | L06    | kg            | 2.7017     | 169,155.00            |
7. Material                   | L07    | kg            | 2.7017     | 169,155.00            |
8. Material                   | L08    | kg            | 2.7017     | 169,155.00            |
9. Material                   | L09    | kg            | 2.7017     | 169,155.00            |
10. Material                  | L10    | kg            | 2.7017     | 169,155.00            |
11. Material                  | L11    | kg            | 2.7017     | 169,155.00            |
12. Material                  | L12    | kg            | 2.7017     | 169,155.00            |
13. Material                  | L13    | kg            | 2.7017     | 169,155.00            |
14. Material                  | L14    | kg            | 2.7017     | 169,155.00            |

TOTAL HARGA PERKIRAAN: 2,281,751.00

E. OVERHEAD & PROFIT
1. Biaya Tambahan              | L01    | jam           | 1.0000     | 60,000.00            |
2. Biaya Tambahan              | L02    | jam           | 1.0000     | 60,000.00            |
3. Biaya Tambahan              | L03    | jam           | 1.0000     | 60,000.00            |
4. Biaya Tambahan              | L04    | jam           | 1.0000     | 60,000.00            |
5. Biaya Tambahan              | L05    | jam           | 1.0000     | 60,000.00            |
6. Biaya Tambahan              | L06    | jam           | 1.0000     | 60,000.00            |
7. Biaya Tambahan              | L07    | jam           | 1.0000     | 60,000.00            |

TOTAL HARGA OVERHEAD & PROFIT: 240,333.19

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4. Conclusion

Based on the results of the cost analysis using the Conventional Method with the Precast method, it was found that:

1. Based on the Conventional Concrete Implementation Method with Precast concrete, it was found that the use of the Hollow Core Slab Precast Method was used in the field due to the dense terrain and work location area and also needed a fast time in the process and considering the cost factor, in this project it was used Precast Hollow Core Slab plates for pedestrian areas, while for firefighting areas or evacuation routes using conventional concrete.

2. From the results of the detailed analysis above, it is found that the comparison between conventional concrete and precast concrete, where the price of conventional slab concrete work requires a cost of Rp. 3,256,890. Meanwhile, for concrete work using the Precast method, a fee of Rp. 4,206,546 for every cubic meter of work, so that in terms of cost, conventional plates are preferred for the use of slab work.

3. The percentage difference between conventional concrete and precast concrete using a detailed analysis is 22.6%, this means that the contractor can consider the use of conventional floor slabs in work because the price is cheaper than precast floor slabs, but does not consider the time factor.

Table 3. Cost Analysis of Hollow Core Slab Plate

<table>
<thead>
<tr>
<th>No.</th>
<th>MACAM PEKERJAAN</th>
<th>UNIT</th>
<th>VOLUME</th>
<th>HARGA SATUAN</th>
<th>JUMLAH HARGA</th>
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<tr>
<td>I</td>
<td>Pekerjaan BetonKonvensional</td>
<td>M3</td>
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<td>3,256,890</td>
<td>3,256,890,68</td>
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<td>II</td>
<td>Pekerjaan PrecastHollow Core Slab</td>
<td>M3</td>
<td>1,00</td>
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<td>4,206,546,09</td>
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<tr>
<td>III</td>
<td>SELISIH I - II</td>
<td>Rp</td>
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<td>949,656,41</td>
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<tr>
<td>IV</td>
<td>PROSENTASE</td>
<td>%</td>
<td></td>
<td>22,6%</td>
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</tr>
</tbody>
</table>
5. Suggestion

Based on the results of the cost analysis using the Conventional Method with the Precast method, the authors provide the following suggestions:

1. Addition of analysis for the time factor to complete the maximum results.

2. To conduct more research on the aspects studied to get better results, so that factors that can be considered as component selection can be more precise (Expert Suggestions II).

3. Implementation of the Precast Hollow Core slab method is very possible to implement, but requires precision and expertise in the manufacturing process to installation (Expert Advice II).

References


Swastika, IW, & Rosyadi, SF (2013). Time And Cost Efficiency Implementation Methods Plate Concrete Precast Half Slab Of Cast In-Situ (The Efficiency of Time and Cost for Making Concrete Plate by Precast Half Slab Method To Cast In-Situ). Sainstech, 23 (2), 60–63.


Biography

Fauzi Rauyan is a student born in Majalengka, 10 February 1997, the student level end of the Departmen of Civil Department of Mechanical civil, University of Mercu Buana.