COMPARISON OF SYSTEM METHODS (TABLE FORM) WITH SEMI SYSTEMS FROM COST ASPECTS IN THE APARTMENT MEIKARTA PROJECT

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ABSTRACT

Meikarta Apartment Project at the beginning of the implementation of the method that is used is a formwork system so that the spring mounting groove formwork and casting becomes inhibited. With some consideration, the formwork method was changed from the Semi system method to the System (Table Form). Therefore an analysis of costs and time in formwork planning is carried out in order to obtain effective and efficient planning results. At this stage begins with field observations, literature studies include information gathering, problem formulation activities, primary and secondary data and data analysis processing with the Analysis of SNI Work Unit Price (AHS-SNI) 2018 To produce the price of formwork work which includes wages, materials and tool. Based on the results of the analysis carried out on each formwork method, it was concluded that the Cost of Formwork System Work (Table Form) is cheaper compared to Semi system. The total cost of work using the Semi system as much as Rp. 4,837,286,252.27 While using formwork System (Table Form) as much as Rp. 3,724,594,795.77. This shows that work using the System (Table Form) is cheaper by Rp. 1,112,691,456.50 or around 23%.

keywords: Semi Formwork System ; Formwork System (Table Form); Tool; Cost; Time

INTRODUCTION

The development of technology in the world of construction in Indonesia was marked by the growing number of innovations that are used in the process of construction. The role of technology grows even greater, especially to simplify the process that occurs in a construction project. One of the examples of the application of technology in the process of construction is the technology of mold concrete or formwork.

Formwork is a temporary structure because up to a certain time limit will be demolished, while the concrete structure is a permanent structure. M decribes that the structures while is a means of liaison between the design and execution of construction. The structure of the structure permanently not be built without the structures while the .

A formwork construction must meet the requirements of strength, rigidity, and stability. This requirement must be met considering that formwork is a work that is done repeatedly in high rise buildings and requires a large cost to make it (American Concrete Institute). The cost for formwork ranges from 40% - 60% of the cost of concrete works or about 10% of the total building construction cost.

When this in Indonesia there are 3 types of formwork are formwork conventional, semi-systems and systems. Selection of the type of formwork is a decision that is important to the project of building multi-storey as affect the cost, time of work and the quality of construction.
METHODOLOGY

The analysis is done based on the data of secondary that was taken from the location of the research is the Project Apartment Meikarta, with drip emphasis on the problems of the methods, the cost for the work formwork. The results of the analysis can later be used as a reference to evaluate where the system will be used for further projects. In making the analysis of the price of the unit, we must make an analysis coefficient of materials and wages, terms this is done to seek the capacity of materials and wages for 1 m2 her. For wages the coefficient is 1 but the price of wages is made into 1 m2 unit price as well. Specify material and wages are also divided into two kinds, namely materials and wages unloading/tide formwork as well as the materials and wages fabrication formwork. After we calculate the need Cost tool, Cost of materials, and the Cost of wages then the next we sum. The results are already summed multiplied by the volume of work, then we could see the price of a unit of work in total in the rupiah. Both of the tools of conventional and tool systems how is equal.

Table 1. The cost of wages and materials Install and Uninstall Formwork Plate Project Apartment Meikarta

| Description                  | Coefficient | Unit Price ( Rp ) | Total ( Rp ) |
|------------------------------|-------------|------------------|--------------|
| Wage                         |             |                  |              |
| Formwork Settings            | 1           | Rp.42,960        | Rp.42,960    |
| Dismantling Formwork         | 1           | Rp10,688         | Rp10,688     |
| Unloading Install Terminal   | 0.00195     | Rp.192,900       | Rp.376       |
| Total (A)                    |             |                  | Rp.54,023    |
| Material                    |             |                  |              |
| 7cm nails                    | 0.089       | IDR 16,000       | Rp1,424      |
| Mold Oil                     | 0.05        | Rp.17,500        | Rp.875       |
| Plywood / Phenolic 12mm      | 0.3359      | Rp.295,000       | Rp99,091     |
| Torx Screw                   | 8           | Rp.340           | Rp2,720      |
| Torx Bird                    | 0.0175      | Rp10,000         | Rp175        |
| Total (B)                    |             |                  | Rp 104,110   |
| Total (A + B)                |             |                  | Rp 158,133   |

(Source : AHS: SNI 2017-2018, 2019)

Table 2. Additional costs Wages and Materials Install and Uninstall Formwork Plate Project Apartment Meikarta

| Description                  | Coefficient | Unit Price ( Rp ) | Total ( Rp ) |
|------------------------------|-------------|------------------|--------------|
| Wage                         |             |                  |              |
| Formwork Settings            | 1           | Rp.42,960        | Rp.42,960    |
| Dismantling Formwork         | 1           | Rp10,688         | Rp10,688     |
| Unloading Install Terminal   | 0.00195     | Rp.192,900       | Rp.376       |
| Total                        |             |                  | Rp.54,023    |

(Source : AHS: SNI 2017-2018, 2019)

Table 3. Costs for Wages and Fabrication Materials for the Meikarta Apartment Plate Formwork Project

| Description                  | Coefficient | Unit Price ( Rp ) | Total ( Rp ) |
|------------------------------|-------------|------------------|--------------|
| Wage                         |             |                  |              |
| Formwork Fabrication         | 1           | 10,740           | 10,740       |
| Total (A)                    |             |                  | IDR 10,740   |
| Material                    |             |                  |              |
| 7cm nails                    | 0.089       | 16,000           | 1,424        |
| Mold Oil                     | 0.05        | 17,500           | 875          |
| Plywood / Phenolic 12mm      | 0.3359      | 295,000          | 99,091       |
RESULTS AND ANALYSIS

After the unit price has been obtained, then multiplied by the volume of work. For the second floor of the first price of a unit of work post formwork can be added to the price of a unit of work fabrication but after the price which used only the price setting of the formwork. It is happening because of the use of materials formwork can be used up to four times the life.

Table 4. Price of Wage Units and Formwork Materials for Meikarta Apartments Project Plate System

| NO | FLOOR    | VOLUME (M²) | PRICE UNIT (Rp) | AMOUNT (Rp) |
|----|----------|-------------|-----------------|-------------|
| 1  | 4th floor| 1,027.18    | Rp.272,983      | Rp.280,402,678 |
| 2  | 5th floor| 1,027.18    | Rp.272,983      | Rp.280,402,678 |
| 3  | 6th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 4  | 7th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 5  | 8th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 6  | 9th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 7  | 10th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 8  | 11th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 9  | 12th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 10 | 13th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 11 | 14th floor| 1,027.18    | Rp.272,983      | Rp.280,402,678 |
| 12 | 15th floor| 1,027.18    | Rp.272,983      | Rp.280,402,678 |
| 13 | 16th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 14 | 17th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 15 | 18th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 16 | 19th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
| 17 | 20th floor| 1,027.18    | Rp.158,133      | Rp.162,431,055 |
|    | Total Volume (M²) |            | 17,461.99        |             |
|    | Total Price ( Rp ) |            | 3,233,214,426    |             |
|    | Average Unit Price / M² |        | IDR 185,157.27   |             |

(Source: Author’s Processed Data, 2019)
### Table 5. Unit Price for Wages and Formwork Material for Semi-Melkarta Apartment System Project Formation

| NO | FLOOR     | VOLUME (M²) | PRICE UNIT (Rp) | AMOUNT (Rp)  |
|----|-----------|-------------|----------------|--------------|
| 1  | 4th floor | 1,027.18    | 327,006        | 335,894,023 |
| 2  | 5th floor | 1,027.18    | 327,006        | 335,894,023 |
| 3  | 6th floor | 1,027.18    | 212.156        | 217,922,400 |
| 4  | 7th floor | 1,027.18    | 212.156        | 217,922,400 |
| 5  | 8th floor | 1,027.18    | 212.156        | 217,922,400 |
| 6  | 9th floor | 1,027.18    | 212.156        | 217,922,400 |
| 7  | 10th floor| 1,027.18    | 212.156        | 217,922,400 |
| 8  | 11th floor| 1,027.18    | 212.156        | 217,922,400 |
| 9  | 12th floor| 1,027.18    | 212.156        | 217,922,400 |
| 10 | 13th floor| 1,027.18    | 212.156        | 217,922,400 |
| 11 | 14th floor| 1,027.18    | 327,006        | 335,894,023 |
| 12 | 15th floor| 1,027.18    | 327,006        | 335,894,023 |
| 13 | 16th floor| 1,027.18    | 212.156        | 217,922,400 |
| 14 | 17th floor| 1,027.18    | 212.156        | 217,922,400 |
| 15 | 18th floor| 1,027.18    | 212.156        | 217,922,400 |
| 16 | 19th floor| 1,027.18    | 212.156        | 217,922,400 |
| 17 | 20th floor| 1,027.18    | 212.156        | 217,922,400 |

Total Volume (M²) (A) 17,461.99

Total Price (Rp) (B) 4,176,567,293

Average Unit Price / M² (B / a) Rp 239,180.49

( Source : Author's Processed Data , 2019 )

**Job Unit Price Analysis**

After we calculate the need for tools, materials, and wages, we add them up. Then we can see the price of the work unit per m². Both of the tools of conventional and tool system. Here is a recap of the price of Rap tools, materials, and wages on the job beam and plate. Here we can see the price comparison between formwork systems and conventional formwork.
Semi Formwork System

Table 6. Price Works Formwork Plate Semi System Project Apartments Meikarta

| Description                  | Volume (M²) | Unit Price ( Rp ) | Total ( Rp )     |
|------------------------------|-------------|------------------|-----------------|
| Formwork Equipment Rental Costs | 17461.99    | 32432,19         | 660,718,959.27  |
| Wage and Material Costs      | 17461.99    | 239,180.49       | 4,176,567,293   |
| **Total Cost**                |             |                  | IDR 4,837,286,252,27 |

(Source: Author's Processed Data, 2019)

So, the Total Cost of Work if by using Semi System formwork is = Rp 4,837,286,252,27

Formwork System (Table Form)

Table 7. Price Works Formwork Plate system (Table Form) for Meikarta Apartments Project

| Description                  | Volume (M²) | Unit Price ( Rp ) | Total ( Rp )     |
|------------------------------|-------------|------------------|-----------------|
| Formwork Equipment Rental Costs | 17461.99    | 28,140.00        | 491,380,399     |
| Wage and Material Costs      | 17461.99    | 185,157.27       | 3,233,214,397   |
| **Total Cost**                |             |                  | Rp 3,724,594,795.77 |

(Source: Author’s Processed Data, 2019)

So, the Total Cost of Work if by using Semi System formwork is = Rp 3,724,594,795.77

Conclusion, the Total Cost of Work using the Formwork System (Table Form) is cheaper than using the Semi System formwork worth = Rp 1,112,691,456,50

CONCLUSIONS

From the results of the analysis and discussion about the need for tools, materials, and wages and we add up, can we see the total costs are required. Both of the tools formwork Semi systems and tools formwork system (Table Form), then it can be drawn conclusions as follows:

1) After doing the calculations in Chapter IV obtained that the amount of the provision of material formwork (formwork), which takes on the system (Table Form) and Semi System as follows:

Table 8. Total supply of materials formwork Semi System and System (Table Form) Project Apartments Meikarta

| No | Description         | Spring System (Pcs) | System (Table Form) (Pcs) |
|----|---------------------|---------------------|---------------------------|
| 1  | Hollow 40/60        | 2268                | 2268                      |
| 2  | Hollow Double 50/100| 332                 | 332                       |
| 3  | Plat Head           | -                   | 2408                      |
| 4  | U Head              | 2408                | -                         |
| 5  | Angkur U            | -                   | 2408                      |
2) After doing the calculations in Chapter IV obtained that job by using the formwork system (Table Form) is saving around 20% - 25% of beksisting Semi System at work formwork plate floor.

Table 9. Comparison of Cost Works Formwork Plate Semi System and System (Table Form) Project Apartments Meikarta

| Description                        | Comparison of the cost of Formwork Work |  
|------------------------------------|-----------------------------------------|
|                                    | Semi System (Rp)                       | System (Table Form) (Rp) |
| Formwork Equipment Rental Costs    | 660,718,959.27                          | 491,380,399             |
| Wage and Material Costs            | 4,176,567,293                           | 3,233,214,397           |
| Total                              | IDR 4,837,286,252.27                    | Rp 3,724,594,795.77    |

( Source : Author's Processed Data , 2019 )

Conclusion, the Total Cost of Work using the Formwork System (Table Form) is cheaper than using the Semi System formwork worth = Rp. 1,112,691,456 , 50

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