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THE EFFECTIVENESS OF USING HOLLOW AS COLUMN FORMWORK AMPLIFIER COMPARED WITH WOOD BEAM

(A Case Study of Standard Villa Project, Badung)

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Abstract. In terms of cost utilization, formwork is the largest cost component in concrete work on a building project. The cost for formwork is about 40-60% [6] of the cost of concrete work or about 10% of the total cost of building construction. With two methods of formwork i.e. conventional and half system formwork, the authors want to know the comparison of which formwork method is best in the aspect of cost savings, and the execution time for the formwork of columns on the Standard Villa project. From 2 (two) methods proposed then it is chosen the second method; that is formwork column with method of half system as best alternative. The savings can be done from the first method to the second method as much as 26.17%, while in terms of savings time that can be done with method 2 is equal to 5% of method 1.

Keywords: Formwork, Column, Cost, Time.

1. INTRODUCTION

Construction activities are building activities. Generally existing construction buildings tend to use concrete materials. Concrete works consist of iron reinforcement, formwork, and foundry. Concrete requires a formwork as well to get the planned shape. Formwork is a temporary tool, but formwork plays a very important role, to make the form of concrete as desired and depends on the quality of the formwork material itself. The quality of formwork is greatly influenced by the material itself, therefore, the formwork must be made from material that has sufficient quality and needs to be planned in such a way so that the construction does not suffer damage due to deflection or bending arising from the load and foundry process [1].

With the development of technology and the increasingly high demands, especially on the formwork work on concrete structural work, it has triggered the development of various systems and formwork methods with the use of various types of materials and tools. Generally, the most dominant materials used for formwork are wood or bamboo as scaffolding, because wood is a high-strength material with low density, easy to replace and does not require a long time, able to withstand tensile forces and easy to get on the market [2]. However wood is also a material that cannot be used for long spans, has a relatively large expansion and shrinkage, some types of wood are less durable, less homogeneous with defects - natural defects such as the direction of fibers that form cross sections, spirals, diagonals, wood eyes and so on, and some types of wood are less durable, therefore the use of wood as a formwork material needs special and serious attention. In planning formwork work on a construction work, it requires a lot of consideration so that the use of methods or systems that are used is more economical and efficient. Therefore, good planning, supervision and implementation and adequate evaluation methods are needed to anticipate this [1].

In line with the development of the construction world in Indonesia, construction actors are required to find better methods to choose the type of concrete mold. Currently large-scale building projects are increasingly popular by using semi-conventional formwork that uses plywood and hollow iron, although the price of hollow materials is more expensive and easily absorbs heat, but installation with these hollow tends to be faster because the ability to install does not require skills that are too high, fireproof (hollow iron), anti termites and rodents, and have a pretty good quality because the material is suitable to use for long period of time so that it can be used many times. Hollow can reduce the occurrence of deflection in the formwork, so it does not change the form of the formwork. Therefore, the hollow is used as a formwork stiffener and manufacturing formwork (knock down) [3]. Therefore, it is necessary to examine more deeply about the use of hollow as mold reinforcement, especially in concrete column work.

Based on the above thinking, it is necessary to conduct a study of the comparison of the use between conventional and semi-conventional formworks, and then it is done the calculations so that the cost efficiency in the process is obtained. The problems of this research that can be raised in this writing are: 1) which is more effective and efficient between the use of wood beam as formwork reinforcement compared to hollow on column making work?, 2) how much are the cost and time needed between wood beam as reinforcement and hollow formwork as reinforcement for column formwork. The objectives of this research are: 2) to find out which one is more effective and efficient between the use of wood beam as reinforcement formwork compared to the use hollow as formwork reinforcement, 2) to find out how much the cost and time needed between wood beam as a formwork amplifier and *hollow* as column formwork reinforcement. The benefits of this writing are: 1) it can be calculated the comparison of the cost and the time taken between wood beam as formwork reinforcement and hollow formwork as column formwork reinforcement, 2) it can be provided a general description and input to the parties involved in the construction industry about choosing alternative uses from the two comparisons. The scopes used in this study are: 1) observation studies are only limited to column work, 2) the analysis carried out covers the costs and time of column formwork work, 3) Analysis refers to the final results of the formwork work.

2. METHODS

The research method is used as the basis for successive steps based on the research objectives and become a tool used to draw conclusions, so that the expected solutions can be obtained to achieve the success of the research.

2.1 Location and Time

The research location is in the Standard Villa development project which is part of the Greenhill Resort Jimbaran project located at Batu Meguwung street, Jimbaran, South Kuta. The time of research began on August 1, 2017 (for 10 weeks) along with the time of industrial internship.

2.3 Data Collection

To simplify the analysis of the data needed, namely: Image of the structure of the Standard Villa project, Work Unit Prices (HSP), Value Engineering.

2.4 Stage and Research Process

Phase I (Preparation), Phase II (Research Object Determination Stage), Stage III (Data Collection Stage), Stage IV (Data Analysis Stage), Stage V (Discussion Stage)

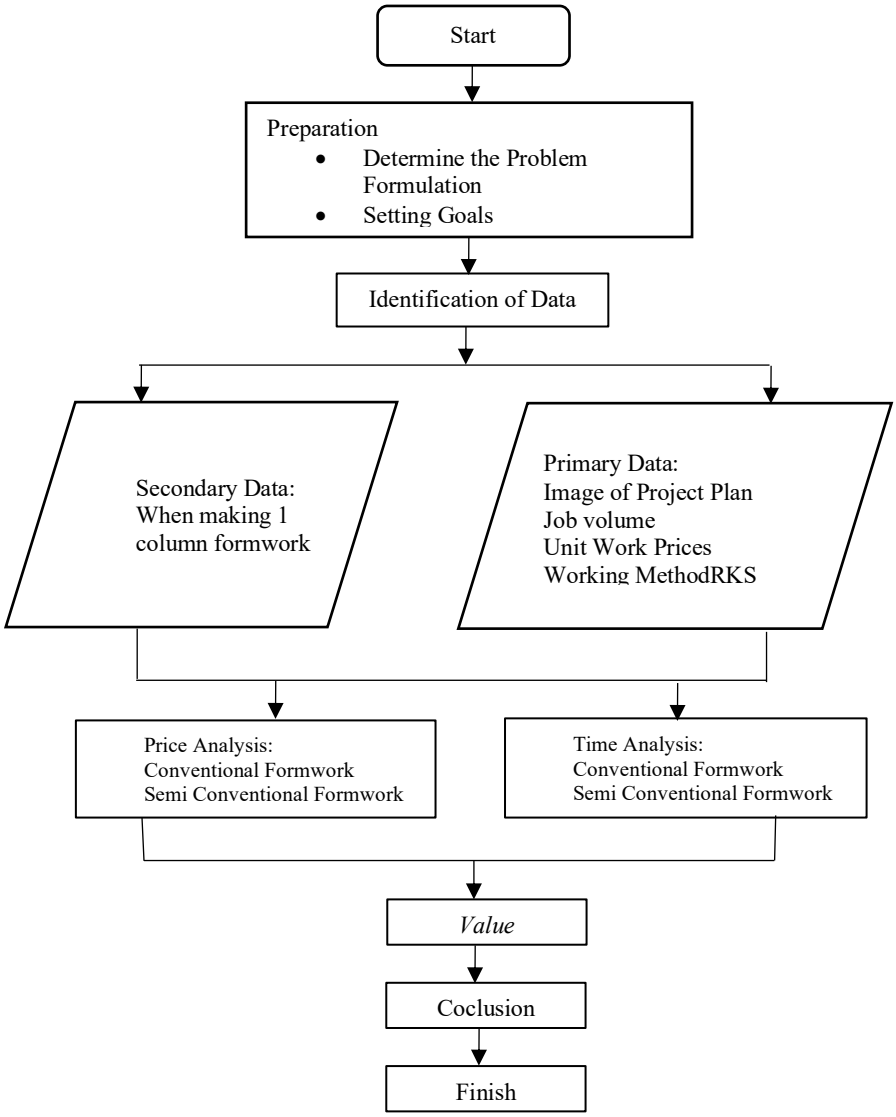

Figure 1. Chart of Research Flow

3. RESULTS AND DISCUSSION

Column is a compressive structural element that plays an important role in a building. Formwork is referred to as a reference and scaffold is a temporary construction that functions as a mold or mall for liquid concrete to finally harden into a building structure [4]-[7]. From the above understanding and according to the plan flow that has been explained previously in carrying out the analysis, it is necessary to analyze it by following step by step.

3.1 Information Stage

The identity of the Standard Villa development project is as follows:

a. The project name : Standard Villa
b. Location : Batu Meguwung street, Jimbaran, South Kuta, Badung, Bali
c. Project owner : PT. Jimbaran Greenhill
d. Cons. Of structure planner : PT. MEINHARDT Indonesia
e. Cons. Of architect planner : GKAI (Grounds Kent Architects Indonesia)
f. Contractor : PT. Tunas Jaya Sanur

3.2 Data Analysis

Calculating the Area of Formwork

Column C1 = 34.74 m^2
Column C2 = 9.264 m^2
Column C3 = 6.176 m^2

3.3 Execution time

a. Conventional Formwork
Installation time = 47 days
Bonding time = 51 days
Time of demolition = 11 days

b. Semi Conventional Formwork
Installation time = 43 days
Bonding time = 47 days
Time of demolition = 11 days

3.4 Cost calculation

a. Conventional Formwork Costs

- For the repetition of formwork for twice, the cost obtained = Rp. 215,731,264.30
- For repetition of formwork for three times, the formwork costs that can be obtained = Rp.176,786,639.87

b. Semi Conventional Formwork Cost

- The use of *hollow* for twelve times and *multiplex* for twice = Rp . 157,160,250.33
- The use of *Hollow* for twenty times and *multiplex* three times = Rp . 130,519,019.39

3.5 Resume

A resume of these costs is shown in Table 1 below:

Table 1. Cost Resume

Description	Conventional		Unit	Semi Conventional		Unit
Time:						
Time installation	47		hour	43		hour
Time Tie it up	4		hour	4		hour
Timetotal	51		hour	47		hour
Time Demolition	11		hour	11		hour
Price	Used 2x	Used 3x	Million	Hollow 12 x and multiplek 2x	Hollow 20x and multiplek 3x	Million
Manufacturing costs 1 unit villa	14.036.042,67	14.036.042,67	Million	32.319.949,76	32.319.949,76	Million
Cost of making a plan	168.432.512,09	112.288.341,39	Million	127.445.905,10	80.190.056,05	Million
Damage fee	24.777.968,22	33.788.138,48	Million	7.193.561,23	9.809.401,67	Million
Wage fee	2.649.504,00	3.612.960,00	Million	2.649.504,00	3.612.960,00	Million
Installation costs	9.935.640,00	13.548.600,00	Million	9.935.640,00	13.548.600,00	Million
Demolition costs	9.935.640,00	13.548.600,00	Million	9.935.640,00	13.548.600,00	Million
Total Cost	215.731.264,30	176.786.639,87	Million	157.160.250,33	130.519.019,39	Million

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusion

a. From the results of cost and time analysis, it is drawn the following conclusions:
   a) Formwork with conventional semi-systems is more effective because the time needed is 5% faster than conventional systems.
   b) Semi conventional formwork is more efficient because the costs required for semi-conventional formwork (1) are 27.12% less than conventional (1), semi-conventional Formwork (2) is more efficient because of the costs required for semi-conventional formwork (2) that is 26.17% less than conventional systems (2) and in this Standard Villa project.
   c) The savings that can be made from conventional formwork (2) is 18.05% from conventional formwork (1), and savings that can be made from semi-conventional formwork (2) is 16.95% compared to semi-conventional formwork (1).

b. From the calculation of costs and time formwork, it can be concluded that:
   a) For the conventional formwork work (1) a fee of Rp.215,731,264.30 is obtained, whereas for conventional formwork (2) the cost obtained is Rp.176,786,639.87 with the implementation time of 61 days.
   b) For semi-conventional formwork work (1) a fee of Rp. 157,160,250.33 is obtained, while for semi-conventional formwork work (2) it is obtained the cost of Rp.130,519,019.39 with a implementation time of 58 days

4.2 Recommendations

a. This comparison is not only done on column formwork structure work but it can also be done on jobs that have the potential to be compared, such as beam formwork, plates formwork, etc.
b. For parties engaged in construction services for large-scale projects, it is better to use semi-conventional systems when doing formwork, especially for column formwork.
c. In order for the implementation of the comparison to be more varied, it is better to use more and broader methods and comparative criteria, considering that at this time a variety of materials that are cheaper, easier and more qualified appear.

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