

Labor Productivity Analysis on Reinforced Concrete Foundation Works Reviewed from the Composition of The Working Group

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Abstract:- In the world of construction services, labor productivity is one of the determining factors for the success of a development project. Every worker in all construction sectors must own high work productivity. The high and low work productivity of the workforce greatly affects the implementation time of the construction project. Efforts should be made to increase labor productivity by tightening supervision and paying attention to the composition of each working group so that they can work optimally. This study analyzes the productivity of workers in reinforced concrete structure work, which is devoted to ironwork and formwork installation, by calculating the productivity of various compositions of working groups, and comparing the productivity results of these working groups. The method used to compare working groups is the observation method (direct observation), evaluating behavior for a continuous period time, without intervening in the observed environment.

Keywords:- Productivity; Labor; Construction Projects; Working Group.

I. INTRODUCTION

The construction industry is one of the largest industries in the world, with significant growth every year. With the increasing demand in the construction sector, it is possible that the national construction industry will face serious threats from foreign competitors. A concerted and serious effort needed among national construction service actors so that this industry can continue to maintain its growth and be highly competitive globally.

Man (Human Resources) is one of the most influential factors in a job, including in a construction job. A small job if good human resources in terms of quality and productivity do not support it will not provide maximum and satisfactory results in a project. In fact, due to the inappropriate use of human resources, it can result in a large loss in construction projects.

Productivity is an interdisciplinary approach to setting effective goals, making plans, applying productive ways to use resources efficiently, and maintaining high quality (Soeharto, 2001). Good labor productivity is necessary for the success of a construction project. Labor productivity will also greatly affect the amount of profit or loss of a project. The most famous

measure of productivity relates to labor which can be calculated by dividing expenditure by the amount used or the hours worked per person (Sinungan, 2014). In the implementation in the field, this can sometimes happen due to the ineffective workforce in their work. Increased productivity and efficiency are the main sources of growth for realizing sustainable development. On the other hand, high and sustainable growth is also an important element in maintaining a long-term sustainable increase in productivity.

As happened in the Corn Bulk manufacturing project at PT. CJ Cheil Jedang Feeds Kalimantan. The casting process for the manufacture of reinforced concrete foundations often does not pass the inspection results. This is influenced by the short duration of the work, because the schedule for the completion of the work must coincide with the corn harvest. The large number of trucks transporting corn that arrives at the time of the corn harvest is not matched by the road access that is not too big, causing congestion around the project area, causing delays in the mobilization process to the project area. To be able to solve this problem, the contractor as the executor in the field must really be able to take advantage of every available work duration outside the corn harvest time with maximum results. This can be solved by increasing the productivity of the working group, by arranging the right composition to carry out the work.

In this research, related to previous research, as a reference is the problem of labor productivity, to determine the optimal composition of the working group. The research plan will be implemented on workers who carry out ironwork and formwork installation on Pile Cap and Tie Beam, in the Corn Bulk foundation construction project at PT. CJ Cheil Jedang Feeds Kalimantan, because the casting process uses ready mix, so the productivity of the workers is uncountable. The group of workers to be observed consists of a combination of Builders and Workers, with a composition of 1:3, 2:2, and 2:3. The determination of the composition of workers used today is adjusted to the actual conditions in the field, where the contractor implementing the work has determined the composition of workers consisting of 4-5 people for each zone.

Observations of this working group were carried out by comparing the working group through the observation method (direct observation), evaluating behavior for a continuous period, without intervening in the observed environment. By doing this research, it is hoped that it can be a suggestion to the implementing contractor, so that the process of ironing and installing formwork for the manufacture of reinforced concrete

foundations can take place effectively and efficiently, with the best quality. So that the casting process can be completed on time.

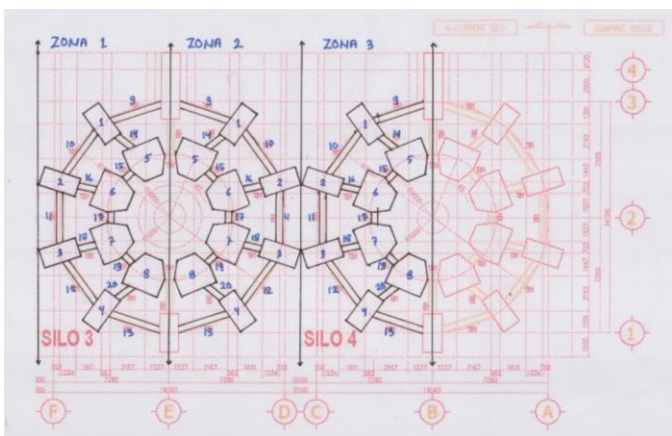
II. RESEARCH METHOD

The object studied as a source of data in this study is the Workforce Group for Reinforced Concrete Foundation Work on the Corn Bulk Construction Project at PT. CJ Cheiljedang Feed Kalimantan. The subjects studied were the Productivity of the Workforce Group on the work of ironing and installing formwork. The data collection was obtained by means of interviews and direct observation in the field in order to obtain valid and actual data.

Primary data is data obtained directly from the original source. In this case, the Workforce for Reinforced Concrete Foundation Work on the Corn Bulk Construction Project at PT. CJ Cheiljedang Feed Kalimantan. Direct observation (observation) is carried out to obtain data regarding the volume of work, in this case the work of ironing and installing formwork.

The research was carried out on the Reinforced Concrete Foundation Project on the Corn Bulk Construction Project at PT. CJ Cheiljedang Feed Kalimantan. Observations for data collection were carried out for 7 working hours, for 6 days starting from 08.00 to 16.00, with a one-hour break, from 12.00 to 13.00. The study was conducted on 3 working groups, where each working group did the same job, namely the work of ironing and installing formwork on the Pile Cap and Tie Beam sections. Each group works according to a predetermined zone with the same work volume as shown in Figure 1.

Fig.1 Planned Pile Cap and Tie Beam



The data collected in observations and interviews in the field in the form of the number of workers and builders in one working group. The table of worker profile data can be seen in Table 1. Workers in the composition of the working group are workers who have work experience of more than 15 years. Meanwhile, the composition of the working group adjusts to the actual conditions in the field.

Table.1 Employee Profile Data

NO	Name	Age	Working Experience	Profession	Composition of The Working Group
		(Years)	(Years)		
1	Muriadi	45	17	Builder	1:3
2	Ahmed	38	8	Worker	
3	Bejo	35	4	Worker	
4	Sriono	30	9	Worker	
5	Supri	40	20	Builder	2:2
6	Radi	47	15	Builder	
7	Ono	25	3	Worker	
8	Jino	35	6	Worker	
9	Daryono	53	22	Builder	2:3
10	Herman	41	15	Builder	
11	Redi	37	9	Worker	
12	Arif	22	2	Worker	
13	Robert	36	7	Worker	

After obtaining data on the number of workers and the length of working hours. Then the volume of formwork work / day is calculated by calculating the area, especially on Pile Cap and Tie Beam formwork that has been installed completely from the stage of connecting the iron frame to the installation of multiplex layers in each zone. After that, the work productivity (m²/hour/) in a day is calculated and the average productivity of the normal work system is calculated in one week (6 Working Days).

Stages and Procedures the research was carried out systematically. The summary of the stages and procedures of the research to be carried out is as follows:

- Preparation phase. The steps taken are formulating research problems, research objectives, and digging into the literature.
- Survey Stage. The steps taken are the licensing process to the implementer, and the determination of the zone to be observed.
- Data Collection Stage. The step taken is to collect data for the supervisor with his working group, which is needed for field observations.
- Data Analysis Stages. The steps taken were to collect and analyze research data in the form of volumes produced by each working group.
- Discussion Stage. The step taken is to compare the results of productivity between groups, to produce a conclusion.

III. RESULTS AND DISCUSSION

The assessment of the data needed in this study is based on the results of observations and interviews that have been conducted on several types of working groups, namely:

- 1 Builder + 3 Workers
- 2 Builders + 2 Workers
- 2 Builders + 3 Workers

The composition of this working group was taken based on actual conditions in the field. The builder professions referred to in the working group are workers who have work experience of more than 15 years. As for what is being researched is the productivity produced by each working group with various compositions, to find out which composition is the most effective in doing work.

At the job site, the ironing process for pile caps and tie beams has been assembled in the workshop and transferred to the material drop area, so that each working group has the same distance to pick up material. For the work process, each working group puts the assembled iron into the pile cap and tie beam positions, then connects it using a bendrat iron, so there is no need for builders and workers who have special skills related to iron work. For the calculation of the volume of cubication work progress every day using the percentage of the results of ironwork and formwork installation. For example, if a pilecap with a concrete volume of 4 m³ consists of 556 Kg of iron and 8 m² of multiplex, then 139 Kg of iron work and 2 m² of installed multiplex are calculated as 1 m³ of work volume.

For the process of installing formwork, the same treatment is carried out as for ironwork. The multiplex used as formwork material uses used formwork from previous work. Multiplex materials are placed at the front of each zone, so that each working group has the same distance to pick up materials.

Table.2 Data on the Calculation of Average Productivity

Working Group Composition	Type of work	Day	Total worker	Working Hours	Volume	Productivity m ³ /hours
1:3	Formwork Installation and Iron work on pile cap and tie beam	1	4	8.00	8.0	1.00
		2	4	7.00	7.0	1.00
		3	4	7.15	7.0	0.98
		4	4	9.00	9.0	1.00
		5	4	7.00	6.0	0.86
		6	4	8.00	8.0	1.00
		7	4	4.00	5.0	1.25
	Average				50.0	1.01
2:2	Formwork Installation and Iron work on pile cap and tie beam	1	4	8.00	8.0	1.00
		2	4	7.00	8.0	1.14
		3	4	7.15	8.0	1.12
		4	4	9.00	12.0	1.33
		5	4	7.00	7.5	1.07
		6	4	8.00	6.5	0.81
		7	-	-	-	-
	Average				50.0	1.08
2:3	Formwork Installation and Iron work on pile cap and tie beam	1	5	8.00	8.5	1.06
		2	5	7.00	6.5	0.93
		3	5	7.15	7.5	1.05
		4	5	9.00	9.5	1.06
		5	5	7.00	6.5	0.93
		6	5	8.00	7.5	0.94
		7	5	4.00	4.0	1.00
	Average				50	0.99

Based on the research results shown in table 2, working group 2 with a composition of 2 builders and 2 workers is more efficient in terms of time. Cooperation, so they can complete the work in just 6 working days. Likewise, in terms of costs, working group 2, which has a composition of fewer workers, has a lower amount of wages as well.

If seen from the graph of the volume of work produced by each working group (m³/day), working group 2 is indeed superior in terms of productivity produced every day. This can be seen in the graph in Figure 2 where working group 2 with a composition of 2 builders and 2 workers always dominates the accumulation of work, so that they can complete the work faster, which is within 6 days.

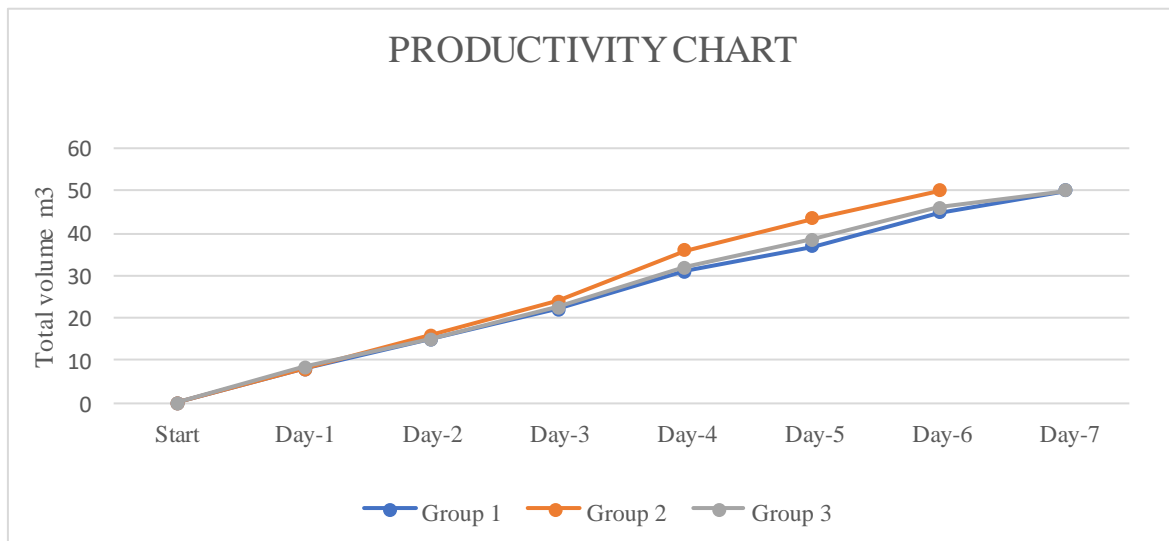


Fig.2 Workgroup Productivity Chart

From the results of observations in the last 1 week, it can be concluded that the things that can affect the value of work productivity are the number of members of the work group. If there are too many people in a work group, it will complicate coordination and narrow the space for movement in the work, so that there will be unemployed workers, as seen in working group 3 with 5 members. Produced causes a decrease in the value of productivity.

The composition between builder and workers in a work group also affects the productivity of the work group on the work of making reinforced concrete foundations. If the number of builder with experience above 15 years is too few, then coordination and cooperation in the working group does not run smoothly, because workers are often confused in doing their work, as seen in work group 1 with only 1 experienced builder in the group, he seems to have difficulty in directing 3 other workers. Therefore, the authors suggest in determining the composition of the working group between builder and workers to be more selective and adapted to the conditions and level of difficulty in the field, so that optimal productivity can be achieved.

In addition, the weather also affects work productivity. Jobs that are often late to start, or often stopped because of rain during working hours can make the value of productivity decrease. Likewise, when it comes to starting work again after it rains, workers need to prepare their work equipment before starting work. Of course, this is quite time-consuming, so the volume of work produced is not optimal.

To validate the observations, the authors conducted interviews with Teguh Prabowo, a site manager from PT. CJ

Cheil Jedang Superfeed Serang, who has 13 years of experience in supervising the manufacture of Corn Bulk spread across 6 factory locations in Indonesia. The informant said that there are 7 factors that affect the productivity of the work of making Corn Bulk, namely:

- Age. The age difference in a person will affect his ability to work.
- Work experience. Work Experience is how long a person works as a worker on a construction project.
- Labor Expertise. If workers have very good skills, they will produce high productivity at work.
- Education Level. In general, people who have higher education will have broad insight
- Workers' health. Healthy workers tend to have high productivity, while sick or unhealthy workers tend to have lower productivity.
- Field Conditions. Possible field conditions such as good weather will accelerate work so that it will not reduce the level of labor productivity.
- Composition of the Working Group. In a construction project, a field head leads a working group consisting of various field workers. The composition of the working group affects the productivity of the workforce as a whole.

From the results of these interviews, the results of the author's observations regarding things that affect productivity, namely the composition of the work group, work experience / period of work, and weather, are relevant to the statements of the informants. Good productivity is influenced by good cooperation between builders and workers, therefore tighter supervision is needed so that optimal work productivity can be achieved. Further research needs to be carried out starting

from fabrication to formwork installation, to the casting process, in analyzing labor productivity in terms of the composition of the working group regarding the work of making reinforced concrete foundations, especially on structural elements and in different field conditions.

IV. CONCLUSION

From the results of the analysis and discussion in the previous chapter, observations regarding labor productivity were carried out specifically for the work of ironing and installing formwork in the Making of Reinforced Concrete Foundations at PT. CJ Cheiljedang Feed Kalimantan, can be concluded as follows:

- The difference in the composition of the working group has an influence on the work of ironing and installing formwork, namely in the form of a combination of fitters and workers.
- The composition of the work group with 2 workers and 2 workers (2:2) obtained the most optimal productivity in terms of time and cost compared to the composition of other work groups, because they were able to complete work faster than other groups.
- The number of members of the work group that is excessive can limit the space for movement in the work area. This is one of the factors that decrease the productivity value for the manufacture of reinforced concrete foundations.

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