

ANALYSIS OF LABOR PRODUCTIVITY ON THE SUMMARECON CONSTRUCTION PROJECT BANDUNG MALL

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Abstract

Located in the East Bandung area Indonesia, in Gedebage to be precise, Summarecon Bandung is an effort to develop the first independent city in the city of Bandung. The progress of project work is at 52.44%, still 0.13% higher than 52.31% for the planned sub-structural work in the following weeks. 21. This study will discuss the analysis of productivity values in reinforcing work to provide information regarding the causes of delays that cause project progress to be delayed, worker performance, and the amount of productivity produced. The method used for data collection includes direct observation, using the Five Minutes-Rating. And direct interviews using the Foreman Delay Survey (FDS) in the form of questions that will be given to field supervisors in order to obtain valid and actual data. The results of the research through observation for 20 minutes with the Five Minutes- Rating is 85% with a comparison of the results of productivity analysis by Foreman A and B are 33% and 17%. The results of the Foreman Delay Survey show that the factors affecting productivity values with the top three rankings are damage to construction equipment, waiting for material (vendor delay), and changes/rework (design errors).

Paper Identification



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I. INTRODUCTION

Located in the east Bandung area, precisely in Gedebage, Summarecon Bandung is efforts to develop the first independent city in Bandung City in order to provide residence Which worthy And provide facility like, shophouse, And areas office, center shopping, educational facilities, etc. PT Summarecon Agung Tbk, itself has a vision to provide value economy in a way sustainable. In implementation, development area Which comfortable lived in And familiar with community become point Summarecon rejected to innovate

Project Summarecon Mall Bandung own area land as big as $\pm 100,504$ m² And wide building $\pm 64,061$ m², with a scope of structural and architectural work. Assumed job duration Overall construction is 14 months (420 days) starting in June 2022 until completion in July 2023. Project work progress is at 52.44%, still 0.13% higher than 52.31% plan for sub structure work in week 21. This means a lot of workers and mobilization materials moving on the project. So this can affect the value of energy productivity Work Which is in the field

Productivity is utilization source Power in a way efficient And effective production For achieve, optimally, set organizational goals [1]. [2] also confirm that productivity increase correlated tall with enhancement profitability, Power competitive, performance mark holder interest main And growth period long as well as continuity something organization, industry or economy (nation). Reason Which stated For low level productivity And Which related with peculiarity industry construction covers characteristics power Work, various work project condition And environment as well as activity non-productive which attached [3].

This study will discuss productivity analysis in steel work with the aim of: give information related reason delay (*Delay*) Which cause *progress* project experiencing delays, worker performance, and the amount of productivity generated. The hope is, Results from analysis This can made as reference in effort For increase mark productivity on the project Summarecon Bandung

II. STUDY LITERATURE

A. Source Power Man

Source Power man is element which the most strategic in organization. Enhancement Productivity can only be done by humans. On the other hand, human resources can also do it cause happen waste And inefficiency in various forms.

There are many methods that can be used to measure labor productivity in field. However, measurement productivity labor in a way accurate hard to do. Method data collection includes *a five-minute rating* and *foreman delay survey* is a method that approach Can used For measurement productivity. Wrong one approach for know level productivity power work is with use method Which classify worker activities.

Lazy work or corrupt working hours than they should be, is not it supports development, but hinders the progress that should be achieved. Instead, work effective according to the required number of working hours and work in accordance with the job description each worker, will be able to support progress and encourage the smooth running of good business in a way individual nor overall [4].

B. Understanding Productivity

Say productivity own definition which different For every individual. By general productivity can defined as ratio between input and output. Output is a tangible result in physical form that has value and benefits for society. Whereas input is source Power Which can form material or service. Productivity Alone can be the size production efficiency.

C. Factors Which Influence Productivity

According to [5] variables that influence labor productivity field can grouped become several things. Following is a number of the factor :

1. Condition physique field and means help
2. Climate seasons and circumstances weather
3. Circumstances physique field
4. Means help
5. Composition group Work
6. Size big project
7. Curve experience
8. Density labor

D. Foreman Delay Surveys (FDS)

Foreman Delay Surveys (FDS) depend on questionnaire which will filled by foreman work at the end of the working day according to a certain survey schedule, for example, one working week in every month. This questionnaire is mainly intended to identify the number of hours of the day lost due to delay. FDS are divided into rework and and categories delay.

After form filled, information extracted in form percentage And no way Which taken to ensure that sources of delay are properly addressed. FDS is a fee relatively low method For analyze source lateness during construction. That can with easy arranged and implemented.

E. Five-Minutes Ratings

Five-Minutes Rating, unlike *work sampling*, is not based on statistical *sampling theory*. Method This simple that is with observe operation For time Which short. These observations did not produce a large enough sample to support *the work taken sampling*. This method does however provide some insight into crew effectiveness and can identify areas Where observation more carry on required. Procedure following can used to apply technique *5-minute ratings* :

1. Identification member crew which will observed and arrange form
2. Observe the crew as they work. For example observation intervals, the interval is the same as 5 minutes, determine whether the crew member has been active for more than half of the interval. If thereby mark observations cell with “√”; If No, let empty cell.

3. Add observation “√” For all over table And share amount with amount total observation For get mark effectiveness from the work.

III. METHODOLOGY

In this research, the methodology used was arranged systematically to make it easier productivity calculation process. Stages of preparing research in the form of a flow diagram can be seen in Fig 3.1.



Figure 3.1. Diagram Flow Study

Study started with identification work and data field for understand productivity calculations carried out during field visits. Data obtained is a series labor productivity with labor groups on structural works. Then done studies literature about calculation productivity. Objective furthermore is give conclusion And determine recommendation implementation Which done based on calculation productivity.

A. Data General Project

This following data is the project data which is review in this paper.

Table 3.1. Data General Project

No	Details	Information
1	Project Name	Summarecon Mall Bandung
2	Surface Area	100,504 m ²
3	Building Area	64,061 m ²
4	Work Scope	Structural and Architecture
5	Owner	PT. Mahakarya Buana Damai
6	QS Consultant	PT. Rekagriya Mitra Buana
7	Construction Management	-
8	Architect Consultant	Cadiz International Middle East FZLLC and PT. Anggara Architeam
9	Structure Consultant	PT. Arsini PRIma Cipta
10	MEP Consultant	PT. Arnan Pratama Consultants

Source: Document PT. Jagat Construction

B. Method And Instrument Collection Data

1. Method Collection Data

In this research, researchers used the Quantitative Descriptive method, namely observation direct (observation) and direct interviews in the field. This method was taken because of the source The data used is from field supervisors who work in the field to obtain data which valid and actual from field.

Method which used for collection data covers observation direct, time taking activity production with use *five-minutes ratings*. Observation direct used to assess worker effectiveness based on *Activity Sampling* .

In FDS (*Foreman Delay Survey*) , Supervisor field Which asked level And type delays that affect worker performance. Considering his close contact with workers and management, *foreman* is considered more competent in identifying causes any delay and provides an accurate estimate of its duration. Just a delay those beyond control are recorded in terms of sources, length of time lost and number of workers Which affected.

2. Instrument Collection Data

Data collection instruments are tools selected and used by researchers in his activities gather data so that activity the systematic and can done calculation productivity. For determine instrument collection data, researcher mustdetermine in advance the data source and data collection methods used. The following is picture determination instrument collection data study which there is on fig 3.2 inbelow:

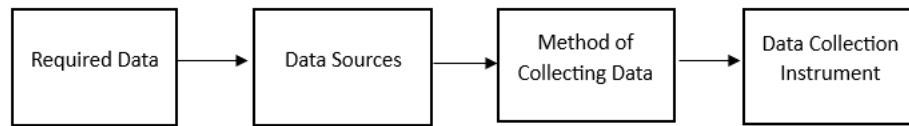


Figure 3.2 Step Determination Instrument Collection Data Study

Apart from the things above, the constraints that exist within the researcher are also factors important things that researchers must consider in choosing their data collection instruments, between other : ability, that is master of knowledge, methodology, energy and time Which available.

In accordance with the data collection method used in this research, the author using interview guides and observation guides as instruments for conducting collection data, besides also consider ability writer alone.

IV. DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS.

A. Five-Minutes Rating

There are four workers who are working on the iron work, therefore the minimum length of observation for the 5-minute rating is 5 minutes per worker, so the total length of observation is 20 minutes because there are four workers.

Tabel 4.1 5-Minutes Rating Iron Work

Time	Iron Work			
	Worker 1	Worker 2	Worker 3	Worker 4
03.00 PM	✓	✓	✓	✓
03.05 PM	✓	✓	✓	✓
03.10 PM	✓	✓	✓	
03.15 PM		✓	✓	✓
03.20 PM		✓	✓	✓
Effective Observation	3	5	5	4
I. Total Observation = 20				

- II. Effective Observation = 17
 III. Effectiveness = 17/22
 IV. 5-Minutes Rating = 85%

From the observation data above, it was found that the 5-minutes rating of the 20-minute iron work was 85%. At 03:10 PM, worker 4 was transporting from his previous workplace to his new workplace. At 03:15 PM, worker 1 left the workplace and did not return until the observation time was over. The value of the 5-minutes rating reaching 85% can be classified as effective because workers do more than 50% of the work without any delay. Although the observed data is not the overall value of the project, this value is the value that took place in the field during the observation.

B. FDS (*Foreman Delay Survey*)

The following data is obtained through the FDS method regarding the amount of production lost per week through the influence of 11 factors. The following is a table of sorted FDS results that have been adjusted by the level of production.

Tabel 4.3 Construction Site Delay Factors by Foreman Delay Survey (FDS)

Date :	Name :		
Total Crew :	General Foreman		
	Foreman's name :		
Problems that cause Delay	Manhours Lost		
	Number Of Hours	Number of Workers	Labour Hours
Change / rework (Design error)	14	3	42
Change/rework (Prefabrication error)	14	2	28
Changes/Rework (Field Errors/Damage)	-	-	-
Waiting for Material (Warehouse)	-	-	-
Waiting for Material (Vendor Delay)	24	2	48
Waiting for Equipment	15	2	30
Construction Equipment Damage	21	15	315
Waiting for Information	730,000	10	7.300.000
Waiting for the rest of the crew	7	3	21

Unnecessary/unexplained movements	8	3	21
Machine Damage	14	1	14

Table 4.4 Factors and Levels of Construction Site Delay by Foreman Delay Survey (FDS)

S/N	Factors	Lost Man Hrs	%	Rank
1	Change / rework (Design error)	42	8.09%	3
2	Change/rework (Prefabrication error)	28	5.39%	5
3	Changes/Rework (Field Errors/Damage)	0	0.00%	9
4	Waiting for Material (Warehouse)	0	0.00%	9
5	Waiting for Material (Vendor Delay)	48	9.25%	2
6	Waiting for Equipment	30	5.78%	4
7	Construction Equipment Damage	315	60.69%	1
8	Waiting for Information	7,300,000		
9	Waiting for the rest of the crew	21	4.05%	6
10	Unnecessary/unexplained movements	21	4.05%	6
11	Machine Damage	14	2.70%	8
Total		519		

Table 4.5 Factors and Levels of Sequential Delay on Construction Sites by Foreman Delay Survey (FDS)

S/N	Factors	Lost Man Hrs	%	Rank
7	Construction Equipment Damage	315	60.69%	1
5	Waiting for Material (Vendor Delay)	48	9.25%	2
1	Change / rework (Design error)	42	8.09%	3
6	Waiting for Equipment	30	5.78%	4
2	Change/rework (Prefabrication error)	28	5.39%	5
9	Waiting for the rest of the crew	21	4.05%	6
10	Unnecessary/unexplained movements	21	4.05%	6
11	Machine Damage	14	2.70%	8
3	Changes/Rework (Field Errors/Damage)	0	0.00%	9

	Errors/Damage)			
4	Waiting for Material (Warehouse)	0	0.00%	9
8	Waiting for Information	7,300,000		
Total		519		

From the results of Table 4.3, Waiting for information is the main factor that gives the most influence on the value of productivity. However, based on our data, we did not include it in the ranking because it has a very high value if included in the percentage category compared to other jobs. The factor of waiting for information is very high because if there is a change in design but there is no decision yet, then the work in the field will be held because it must be consulted and coordinated in advance by other parties related to each specialist in accordance with their respective work and field, for example in the pit lift work the dimensions required for the elevator are 2m x 3m then the field also needs to work larger than the dimensions of the pit lift so that the elevator can be used properly and the change must be consulted by the party related to the pit lift specialist.

The next rank with the second rank, is in the work of construction equipment damage, especially for bar cutters and bending bars because the tools used in the field amount to 10 units of bar bending and 5 units of bar cutter, so there is a high probability of damage. The two tools are complementary tools used in iron work. Of course, both tools have equally important functions. If the bar cutter is used for cutting then the bending bar is used for bending. When choosing a bar cutter, you must also pay attention to the engine power. This is very important because engine power has a big influence on the strength and torque released when the tool is used which will affect the damage to the cutter bar.

The next rank with the third rank, is waiting for materials (vendor delay), in the Summarecon Mall Bandung Project the materials used are ordering materials by the owner. Therefore, coordination must be carried out regularly by the contractor to the owner for the availability of materials and there is also negligence from suppliers (vendors) in handling the delivery of goods. For this reason, so far, the contractor PT. Jagat has anticipated with material requests in advance and once a week (every Tuesday) monitoring the available iron. When the fixings are available in the field, PT. Jagat also needs to check and control the delivery from the supplier (vendor). The assignor also provides dispensation if the delay is caused by the owner.

Some other factors that affect the value of productivity that give a fairly low value are changes / rework (design errors) with a percentage value of 8.09%, waiting for equipment with a percentage value of 5.78%, changes / rework (Prefabrication errors) with a percentage value of 5.39%, waiting for other crews with a percentage value of 4.05%, unnecessary / unexplained movements with a percentage value of 4.05%, machine damage with a percentage value of 2.70), waiting for materials (warehouse) with a percentage value of 0% which means it does not affect the delay because PT. Jagat and the stakeholders involved are meant to anticipate in advance for the materials in the warehouse and finally for changes / rework (errors in the field / damage) directly done by the contractor PT. Jagat and does not affect the delay because the work does not affect other work.

C. Comparison between Field Results and PT Jagat Results

Table 4.6 Productivity values obtained from PT. Jagat

Observation	Volume (Kg)	Duration (Days)	Number of Workers	Worker Productivity / per 20 minutes	Worker Productivity/per Person	Worker Effectiveness/ per minute
Foreman A	80,929.92	20	19	56.20	212.97	30%
Foreman B	31,605.95	14	12	31.36	188.13	17%
Foreman C	99,392.91	14	35	98.60	202.84	53%
Total	211,928.48	48	66	186.16	603.94	100%

From the data obtained from PT Jagat that the total productivity of workers per 20 minutes is 186.16, this value is assumed to be the maximum value for worker productivity per 20 minutes per foreman. It was found that for the comparison between the observation of the 5-minutes rating and the results of the report from PT Jagat that the value of effectiveness was still below the value of observations in the field. The average value of the PT Jagat report is still below 50%, which is 33%. From the value of each foreman, Foreman A and Foreman B are still below 50%, which is still not effective, but for Foreman C has exceeded 50%, which means that Foreman C has worked effectively, but this value is still below the observation value of the data in the field.

D. Recommendations

From the previous discussion, the recommendation that can be given to PT Jagat in increasing productivity is to improve the damage factor of the tool, this can be done by doing maintenance on the tool regularly, with this the risk of damage to construction equipment is minimal. Next is to increase the productivity of the concreting work to reach the value of the field observation, which is 85%. The performance of Foreman A and Foreman B workers needs to be improved by at least reaching the effective value because the results of PT Jagat are not far from the effective value.

Improve coordination and communication between each stakeholder related to pembesian work. This can avoid misinformation if there are changes to the design, so as to minimize errors in the drilling work and the amount of iron needed according to the amount needed during the initial planning.

V. CONCLUSIONS

From the results of the five-minutes rating, it is found that the value of worker effectiveness at the observation time of 20 minutes is 85%, it can be seen in PT. Jagat's results that the resulting productivity does not reach the

value of the five-minutes rating from field observations. The highest value of PT Jagat's results is 53% for Foreman C. This result can already be considered effective if using the assumption that the maximum productivity value that can be achieved is the total of the three foremen. The value of Foreman A and Foreman B is still far from the effective number with a value of 33% and 17%. Although the value of Foreman C is still effective, this result is still below the value of the five-minutes rating observation. This means that the three foremen are still not maximally achieving the value of the five-minutes rating observations made in the field.

From the results of the Foreman Delay Survey, it is found that the top three values of factors affecting work productivity in order from the top rank are construction equipment damage, waiting for materials (vendor delay), and changes / rework (design errors). The construction equipment damage factor is the highest factor in causing delay in the concreting work. This factor needs to be explored further because, if the construction equipment damage factor can be reduced, the delay that occurs in the concreting work will be significantly reduced. The second top factor and the third top factor cause delay, but the resulting percentage value is much smaller than the first factor. All factors causing delay need to be addressed, but the most important one to prioritize is the first factor, which is construction equipment damage. This is obtained by excluding the factor of waiting for information in the calculation, because if it is included in the calculation, the Foreman Delay Survey calculation is not good, because the number of factors waiting for information is so large that the calculation results are not good.

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Publications

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