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Analysis of Labor Productivity on Lightweight Brick Work using The Work Sampling Method

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Labor; Productivity; Work Sampling

Abstract

One of the important elements in the construction process is lightweight brick work. Labor productivity in this work is very influential on the progress of the construction project as a whole. One method that can be applied to analyze labor productivity is work sampling, which is an observation method used to measure and analyze the productivity of workers or activities at a certain time. This study aims to investigate and analyze labor productivity of lightweight brick work labor. The work sampling method was chosen to analyze the productivity and quantity of labor in lightweight brick work on the Bekasi Mixed Use Development Pakuwon Residence project. Based on the analysis and discussion during the 10-day observation period, 8 lightweight brick masonry workers completed work with a total area of 658.480 m2 and obtained a productivity value of 52,730 m2/day. In addition, from the results of field observations, the level of worker adjustment factors and allowances can still be increased, with the hope that this increase will significantly increase worker productivity in terms of time, quality, and quantity.

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1. Introduction

The construction industry is an economic sector that has a vital role in infrastructure and property development. During the construction process, one important element is lightweight brick work, which forms the foundation of the building with lighter and easier-to-work materials. Labor productivity in these jobs significantly impacts the overall progress of a construction project. The resources that influence the project consist of people, materials, machines, money, and methods (Arruan et al., 2014).

In general, measuring labor productivity in construction is often carried out using conventional methods, which may not be wholly accurate or efficient. So, a more detailed and measurable approach is needed to understand the factors that influence the productivity of lightweight brick masonry work on the Pakuwon Residence Bekasi Mixed Use Development project.

Lightweight brick is high-quality lightweight concrete produced using German technology and Deutch Industries Norm (DIN) standards. In the Pakuwon Residence Bekasi Mixed Use Development project, the lightweight bricks came from Broco Industries with dimensions of 60 cm x 20 cm x 7.5 cm. According to (Rori et al., 2020), lightweight bricks have several advantages, namely accurate size makes work easier and reduces the need for finishing, high compressive strength with lightweight, good heat and sound insulation, easy to shape and work on, speeds up construction and does not poisonous.

Productivity measures the efficiency or results produced by an activity or process per unit of time or resources used, reflecting the ability to produce output by utilizing input effectively. Productivity is often measured as the ratio between output and input and can be applied to various contexts, such as employment, industry, or the economy as a whole (Parulian et al., 2017). The lower the productivity, the greater the likelihood of work delays. Conversely, the higher the productivity level, the lower the likelihood of delays (Bamayi et al., 2022). Productivity in construction projects is influenced by the ability of labor performance, where differences in productivity between workers can be caused by various factors, which can cause delays in the project development process and increase costs to be incurred (Liespono et al., 2023).

Labor productivity is a measure of efficiency and effectiveness in using human resources to complete a task or job. Low work productivity can make it difficult for companies to achieve work targets and result in them falling behind in competition with other competitors (Sutiko et al., 2021). Labor productivity includes not only the amount of work completed but also the quality of the work's results. The importance of labor productivity in a job is to avoid wasting time and ensure completion according to plan and still produce quality results (Syahrir et al., 2023). The approach to knowing the level of labor productivity is to use a method that classifies work activities (Harun, 2013). In this research, observations were carried out using the work sampling method with a productivity rating approach, where work activities were classified into 3 things, namely Essential contributory work, Effective, and Not useful (Harun, 2013).

The difficulty in considering labor productivity arises from the complexity of project productivity issues, influenced by various internal and external factors (Desfita et al., 2021). External factors such as weather, economy, and government regulations cannot be controlled by project management, and internal factors are the most dominant factors in influencing performance, such as skills, experience, labor force, material control, and communication (Lalujan et al., 2022).

One method that can be applied to analyze labor productivity is the work sampling method. The work sampling method involves taking a random sample of the work or activity being performed by workers over a period of time (Yanti, 2017). Work sampling can provide a general idea of how work time is spent, how often certain jobs are performed, and other factors influencing productivity. Work sampling is a technique for observing the performance activities of machines, processes, workers, or operators (Setyabudhi, 2022). However, as with any measurement method, the results of work sampling need to be interpreted with caution and take into account the context of the work and the potential inaccuracies of the samples taken (Prasetyo et al., 2017). In work sampling, observers randomly choose times to record worker activities at certain time intervals, such as recording the type of work, time spent, and environmental factors that influence productivity.

The work sampling method is expected to provide accurate and representative data regarding work activities, enable the identification of unproductive time, and provide a basis for productivity improvement strategies. Based on the description above, this research aims to investigate and analyze labor productivity in lightweight brick work on the Pakuwon Residence Bekasi Mixed Use Development project using the work sampling method.

2. Research Methods

The research location is the Pakuwon Residence Bekasi Mixed Use Development Project. This project consists of 4 apartment towers, 1 hotel tower, and a mall with an area of 31.392 m2. It is located at Jl. Raya Pekayon, RT.01/RW.03, Pekayon Jaya, Kec. Bekasi Selatan, Kota Bekasi, Jawa Barat 17148. The following is a detailed image of the project location using an image from Google Earth, as shown in Figure 1.

Figure 1. Pakuwon Residence Bekasi Mixed Use Development Project Location

Source: Google Earth

Before carrying out observations in the field, first, determine the observation time using the random number table (Sutalaksana et al., 2006), shown in Table 1 below.

Table 1. Random Table Number

39	65	76	45	45	19	90	69	64	61	20	26	36	34	62	58	24	97	14	97
95	06	70	99	00	73	71	23	70	90	65	97	60	12	11	31	56	34	19	19
47	83	75	51	33	30	61	38	20	46	72	20	47	33	84	51	67	47	97	19
98	40	07	17	66	23	06	09	51	80	59	78	11	52	49	75	17	25	69	17
17	95	21	78	58	24	33	45	77	48	69	81	84	09	29	93	22	70	65	80
37	48	79	88	74	63	52	06	30	34	01	31	60	10	27	35	07	79	71	53
29	99	52	01	41	02	89	08	16	94	55	53	83	29	95	56	27	09	24	43
21	78	59	09	82	72	61	88	73	61	87	18	15	70	07	37	79	49	12	38
48	13	93	55	96	41	92	45	71	51	09	18	25	58	94	98	83	71	70	15
89	09	39	59	24	00	06	41	41	20	14	36	59	25	47	54	45	17	24	89
10	08	58	07	04	76	62	16	46	65	58	76	17	14	86	59	53	11	52	21
66	04	18	72	87	43	90	56	37	31	71	81	13	50	41	27	55	10	24	92

Source: (Sutalaksana et al., 2006)

Once 30 pairs of random numbers are selected, they are sorted from the smallest, and calculations are performed to determine the research visit schedule. After determining the observation time, continue with direct observations in the field to record the activities of lightweight brick masonry workers by bringing labor productivity analysis tables and other necessary tools.

To obtain the value of the adjustment factor on the skill and effort factors, the researcher will conduct interviews with parties directly related to the workers. Then, after obtaining data from the field, proceed with calculation analysis using the work sampling method, which is divided into several steps, which will be explained below.

Conduct preliminary sampling

Observing labor activities to obtain an efficient work system and determining random time intervals. The next step is to conduct field observations.

Data Uniformity Test

It aims to determine whether the time measurement results are sufficiently uniform. Data is said to be uniform if it is within a certain range of control limits. If it is outside a certain limit range, then it is said to be non-uniform. Before calculating data uniformity, the first step must be determining the Upper Control

Limit (UCL) and Lower Control Limit (LCL). The calculation formula for BKA and BKB with the Work Sampling method (Sutalaksana et al., 2006).

$$\text{UCL} = \bar{p} + 3\sqrt{\frac{\bar{p}(1-\bar{p})}{\bar{n}}} \quad (1)$$

$$\text{LCL} = \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{\bar{n}}} \quad (2)$$

p¯and n¯obtained through the following formula:

$$\bar{p} = \frac{\sum p_i}{k} \quad (3)$$

$$\bar{n} = \frac{\sum n_i}{k} \quad (4)$$

Where:
pi : percent productive on day-i
ni : number of observations made on day-i
k : number of observations

Data Sufficiency Test

This test is carried out with a confidence level of 95% and an accuracy level of 5%. The aim is to determine whether the data that has been collected is adequate or not. If N' ≤ N, then the data is considered acceptable. However, if it is not sufficient, additional observations are needed. The formula for calculating the data sufficiency test with the Work Sampling method (Sutalaksana et al., 2006).

$$\text{N'} = \frac{1600(1-\bar{p})}{\bar{p}} \quad (5)$$

Calculating Standard Time

Calculation of standard time, time allowance and adjustment factor of the Work Sampling method (Sutalaksana et al., 2006) is done with the following formula:

$$\text{Productive Percentage (PP)} = \frac{number\ of\ productive}{k} \times 100\% \quad (6)$$

$$\text{Number of Minutes} = PP \times k \quad (7)$$

$$\text{Cycle Time (WS)} = \frac{Number\ of\ Productivity\ Minutes}{Number\ of\ item\ produced} \quad (8)$$

$$\text{Normal Time (WN)} = WS \times Adjusment\ Factor \quad (9)$$

$$\text{Standardized Time (WB)} = WN + (Allowance \times WN) \quad (10)$$

Adjustment factors can be obtained from the observed values of the workforce, which are further adjusted to the factors listed in the following table of Westinghouse method adjustment factors.

Calculating Productivity

After getting the calculation results for standard time, calculate the productivity value using the following formula (Sutalaksana et al., 2006).

$$\text{P} = \frac{O}{I} \quad (11)$$

The output (O) measure can be expressed in the number of physical units of products or services and their rupiah value. In contrast, the input (I) measure can be expressed in the amount of time, labor, labor costs, or materials.

3. Results and Discussion

For this study, 30 random numbers were taken from the table for each worker observed daily. With the following conditions:

1 working day = 8 *hours*
Duration per sample = 5 *minutes*

Maximum samples/hour = $60\ minutes\ /\ 5\ minutes$ = $12\ samples$
Maximum random number = $12\ samples \times 8\ hours$ = $96\ samples$

In this study, 30 sample or labor observations were made each day. To determine the times of these observations, a table of random numbers is used with the condition that the pairs of numbers cannot be more than 96 and there can be no repetition. As a result, 30 random numbers are selected that meet the requirements shown in Table 2 as follows:

Table 2. Sequentially Selected Random Numbers

04	06	09	14	17	19	21	23	27	29	34	36	39	40	45
47	51	58	62	65	69	71	73	77	80	84	89	90	94	96

Source: Analysis Results

Observation time $= Work\ start\ time\ +\ (duration\ per\ sample\ \times\ selected\ number)$
$= 08.00 + (5 \times 04) = 08.20$
$= 08.00 + (5 \times 06) = 08.30$

Then, a similar calculation is carried out until the largest random number is selected. The results of the observation time calculation can be seen in Table 3 as follows:

Table 3. Result of Observation Time Calculation

Selected Random Numbers	Observation Time	Selected Random Numbers	Observation Time
04	08.20 – 08.25	47	11.55 – 12.00
06	08.30 – 08.35	51	12.15 – 12.20
09	08.45 – 08.50	58	12.50 – 12.55
14	09.10 – 09.15	62	13.10 – 13.15
17	09.25 – 09.30	65	13.25 – 13.30
19	09.35 – 09.40	69	13.45 – 13.50
21	09.45 – 09.50	71	13.55 – 14.00
23	09.55 – 10.00	73	14.05 – 14.10
27	10.15 – 10.20	77	14.25 – 14.30
29	10.25 – 10.30	80	14.40 – 14.45
34	10.50 – 10.55	84	15.00 – 15.05
36	11.00 – 11.05	89	15.25 – 15.30
39	11.15 – 11.20	90	15.30 – 15.35
40	11.20 – 11.25	94	15.50 – 16.00
45	11.45 – 11.50	96	16.00 – 16.05

Source: Analysis Results

Table 3 above shows that the observation will start at 08.20 WIB and the last observation will be at 16.00 WIB, with 04 being the smallest selected random number and 96 being the largest.

Field Observation

Table 4 shows the table and the number of labor observation frequencies during the 10 days of the study.

Table 4. Number of Observation Frequencies

Activities	Workers	Observed Frequency on Day-										Total
		1	2	3	4	5	6	7	8	9	10	
Productive	Worker 1	28	21	24	24	27	26	20	30	28	26	254
	Worker 2	26	23	23	24	26	29	29	24	30	22	256
	Worker 3	29	27	26	27	23	26	24	28	23	27	260
	Worker 4	27	25	22	28	24	23	25	26	28	28	256
	Worker 5	26	30	27	21	23	27	27	21	29	26	257
	Worker 6	29	24	24	30	23	21	25	26	23	30	255
	Worker 7	21	20	24	27	28	30	20	28	28	30	256
	Worker 8	26	27	25	24	29	27	25	26	27	25	261

Activities	Workers	Observed Frequency on Day-										Total
		1	2	3	4	5	6	7	8	9	10	
Non-productive (idle)	Worker 1	2	9	6	6	3	4	10	0	2	4	46
	Worker 2	4	7	7	6	4	1	1	6	0	8	44
	Worker 3	1	3	4	3	7	4	6	2	7	3	40
	Worker 4	3	5	8	2	6	7	5	4	2	2	44
	Worker 5	4	0	3	9	7	3	3	9	1	4	43
	Worker 6	1	6	6	0	7	9	5	4	7	0	45
	Worker 7	9	10	6	3	2	0	10	2	2	0	44
	Worker 8	4	3	5	6	1	3	5	4	3	5	39
Productive (pi)	Worker 1	0.93	0.70	0.80	0.80	0.90	0.87	0.67	1.00	0.93	0.87	8.47
	Worker 2	0.87	0.77	0.77	0.80	0.87	0.97	0.97	0.80	1.00	0.73	8.53
	Worker 3	0.97	0.90	0.87	0.90	0.77	0.87	0.80	0.93	0.77	0.90	8.67
	Worker 4	0.90	0.83	0.73	0.93	0.80	0.77	0.83	0.87	0.93	0.93	8.53
	Worker 5	0.87	1.00	0.90	0.70	0.77	0.90	0.90	0.70	0.97	0.87	8.57
	Worker 6	0.97	0.80	0.80	1.00	0.77	0.70	0.83	0.87	0.77	1.00	8.50
	Worker 7	0.70	0.67	0.80	0.90	0.93	1.00	0.67	0.93	0.93	1.00	8.53
	Worker 8	0.87	0.90	0.83	0.80	0.97	0.90	0.83	0.87	0.90	0.83	8.70

Source: Analysis Results

Table 4 above shows the number of productive and non-productive values of workers during the observation process. For example, to get the productive value in decimal form from field observations based on the table above, an example of the first day's worker 1 data is used as follows.

$$p = 28$$
$$n_i = 30$$
$$pi = \frac{p}{n_i} = \frac{28}{30} = 0.93$$

Data Uniformity Test

As an example of calculating the data uniformity test, we will use data from worker 1 as follows.

$$\Sigma pi = 8.467$$
$$k = 10$$
$$\Sigma N = 300$$
$$\bar{p} = \frac{\sum pi}{k} = \frac{8.467}{10} = 0.847$$
$$\bar{n} = \frac{\sum N}{k} = \frac{300}{10} = 30$$
$$UCL = \bar{p} + 3\sqrt{\frac{\bar{p}(1-\bar{p})}{\bar{n}}} = 0.847 + 3\sqrt{\frac{0.847(1-0.847)}{30}} = 1.044$$
$$LCL = \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{\bar{n}}} = 0.847 - 3\sqrt{\frac{0.847(1-0.847)}{30}} = 0.649$$

From the calculation of UCL and LCL above, the productive control chart of labor is shown in Figure 2 as follows.

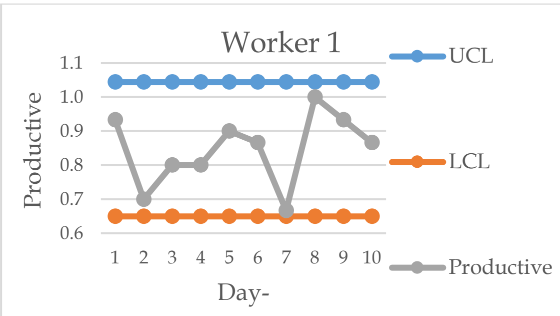

Figure 2. Worker 1 Productive Control Chart

Source: Analysis Results

Figure 2 above shows that the productive value of worker 1 is between the UCL and LCL values, indicating that the worker data is uniform. Table 5 below shows the data uniformity test calculation results for all lightweight brick masonry workers.

Table 5. Data Uniformity Test Results

Workers	$\bar{p} = \frac{\sum pi}{k}$	$\bar{n} = \frac{\sum N}{k}$	$UCL = \bar{p} + 3\sqrt{\frac{\bar{p} - (1 - \bar{p})}{N}}$	$LCL = \bar{p} - 3\sqrt{\frac{\bar{p} - (1 - \bar{p})}{N}}$
Worker 1	0,847	30	1.044	0.649
Worker 2	0,853	30	1.047	0.660
Worker 3	0,867	30	1.053	0.680
Worker 4	0,853	30	1.047	0.660
Worker 5	0,857	30	1.049	0.665
Worker 6	0,850	30	1.046	0.654
Worker 7	0,853	30	1.047	0.660
Worker 8	0,870	30	1.054	0.686

Source: Analysis Results

The calculation results in Table 5 above show that all data can be used because they are uniform. There is no wasted data because the productive value ($\bar{p}$) is between the Upper Control Limit (UCL) and the Lower Control Limit (LCL).

Data Sufficiency Test

The data sufficiency test evaluates whether the data collected from the field is sufficient. As an example of calculating the data sufficiency test, we will use data from worker 1 as follows.

N = 300
$\bar{p}$ = 0.847
N' $= \frac{1600(1-\bar{p})}{\bar{p}} = \frac{1600(1-0.847)}{0,847} = 289.764$

So, the results of the data sufficiency test from Worker 1 get the result N' < N. Then the data obtained can be said to be sufficient. The results of the data sufficiency test for all lightweight masonry workers can be seen in Table 6 below.

Table 6. Data Sufficiency Test Results

Workers	N	$\bar{p}$	$N' = \frac{1600(1-\bar{p})}{\bar{p}}$	Description
Worker 1	300	0.847	289.764	Sufficient
Worker 2	300	0.853	275.000	Sufficient
Worker 3	300	0.867	246.154	Sufficient
Worker 4	300	0.853	275.000	Sufficient
Worker 5	300	0.857	267.704	Sufficient
Worker 6	300	0.850	282.353	Sufficient
Worker 7	300	0.853	275.000	Sufficient
Worker 8	300	0.870	239.080	Sufficient

Source: Analysis Results

From the data sufficiency test in Table 6 above for each worker for 10 days of observation, the result is N'< N, which means the data is sufficient because it has entered the applicable requirements.

Productive Percentage

As an example of calculating the productive percentage, we will use data from worker 1 as follows.

Number of Productive Workers 1 = 254
K = 300
Productive Percentage $= \frac{254}{300} \times 100\% = 84.667\%$

The results of the productive percentage for all lightweight brick masonry workers can be seen in Table 7 below.

Table 7. Productive Percentage Calculation Result

Workers	Total Productive	K	Productive Percentage (%)
Worker 1	254	300	84.667
Worker 2	256	300	85.333
Worker 3	260	300	86.667
Worker 4	256	300	85.333
Worker 5	257	300	85.667
Worker 6	255	300	85.000
Worker 7	256	300	85.333
Worker 8	261	300	87.000
Total	2055	2400	85.625

Source: Analysis Results

The calculation of the productive percentage in Table 7 above shows that worker 8 has the highest percentage result compared to other workers, and the average productive percentage is 85.625%.

Number of Minutes

Before calculating the number of productive minutes of workers, first calculate the amount of time (minutes) used in field observations.

k $= 8\ (Hours) \times 60\ (Minutes) \times 10\ (Days)$
$= 4800\ Minutes$

As an example of calculating number of minutes, we will use data from worker 1 as follows.

Percentage Of Productive Workers 1 $= 84.667\%$
k $= 4800\ minutes$
Number of Minutes $= PP \times Total\ Observation\ Time\ (k)$
$= 84.667\% \times 4800\ minutes$
$= 4064\ minutes$

Table 8 below shows the results of the number of productive minutes for all lightweight masonry workers.

Table 8. Number of Productive Minutes Calculation Result

Workers	Productive Percentage (%)	k	Number of Productive Minutes (Minute)
Worker 1	84.667	4800	4064
Worker 2	85.333	4800	4096
Worker 3	86.667	4800	4160
Worker 4	85.333	4800	4096
Worker 5	85.667	4800	4112
Worker 6	85.000	4800	4080
Worker 7	85.333	4800	4096
Worker 8	87.000	4800	4176
Average	85.625	4800	4110

Source: Analysis Results

The calculation of the number of productive minutes in Table 8 above shows that worker 8 has the highest results compared to other workers, and the average number of productive minutes is 4110 minutes.

Cycle Time

As an example of calculating the cycle time, we will use data from worker 1 as follows.

Number of Productivity Worker 1 $= 4064\ minutes$

Cycle Time $= \frac{Number\ of\ Productivity\ Minutes}{Number\ of\ item\ produced}$
$= \frac{4064}{81,395}$
$= 49.929\ {}^{minute}/_{m^2}$

Table 9 below shows the results of the cycle time calculation for all lightweight masonry workers.

Table 9. Cycle Time Calculation Result

Workers	Number of Productive Minutes	*Number of units produced* (m^2)	Cycle Time (minute/m^2)
Worker 1	4064	81.395	49.929
Worker 2	4096	82.035	49.930
Worker 3	4160	83.558	49.786
Worker 4	4096	82.033	49.931
Worker 5	4112	82.641	49.757
Worker 6	4080	81.708	49.934
Worker 7	4096	81.530	50.239
Worker 8	4176	83.579	49.965

Source: Analysis Results

From the results of Table 9 above, it can be seen that worker 7 has the fastest cycle time with a value of 50,239 minutes/m^2 and the result of the completed area of 658,480 m^2. Where the results of the completed area are obtained from observations in the field during the data collection period.

Normal Time

As an example of calculating the normal time, we will use data from worker 1 as follows.

Cycle Time Worker 1 $= 49,929\ {}^{minute}/_{m^2}$

Adjustment factors are determined based on observations in the field adjusted to the values in Table 10 of the adjustment factor table.

Table 10. Adjustment Factor Worker 1

Factor	Value
Skill (*Good Skill*, C1)	0.06
Effort (*Good Effort*, C2)	0.02
Working Condition (*Good*, C)	0.02
Consistency (*Good*, C)	0.01
Total	0.11

Source: Analysis Results

Normal Time (WN) $= WS \times Adjustment\ Factor$
$= 49,929 \times (1 + 0,11)$
$= 49,929 \times 1,11$
$= 55,297\ {}^{minute}/_{m^2}$

Table 11 below shows the results of calculating the cycle time of all lightweight brick masonry workers.

Table 11. Normal Time Calculation Results

Workers	Value				Total	Cycle Time	Normal Time
	Skills	Effort	Working Condition	Consistency			
Worker 1	0.06	0.02	0.02	0.01	0.11	49.929	55.297
Worker 2	0.00	-0.02	-0.03	0.01	-0.05	49.930	47.558
Worker 3	0.03	0.02	0.01	0.00	0.06	49.786	52.798
Worker 4	0.02	0.00	-0.04	0.00	-0.03	49.931	48.608

Workers	Value				Total	Cycle Time	Normal Time
	Skills	Effort	Working Condition	Consistency			
Worker 5	0.05	0.01	-0.04	0.00	0.01	49.757	50.280
Worker 6	0.00	-0.04	-0.03	0.00	-0.08	49.934	46.114
Worker 7	0.03	0.02	0.02	0.00	0.07	50.239	53.756
Worker 8	0.02	0.00	-0.03	-0.04	-0.05	49.965	47.341

Source: Analysis Results

Table 11 above shows that each worker has different results for each factor based on observations in the field. The results of the adjustment factors above also vary according to each worker's factors, with some having high and low normal times. The largest normal time is in the value of worker 1, which is 55,297 minutes/m^2.

Standard Time

As an example of calculating the productive percentage, we will use data from worker 1 as follows.

Normal Time Worker 1 $= 55{,}297\ ^{minute}/_{m^2}$

The allowance factor for worker 1 can be seen in Table 12 below.

Table 12 Allowance Factor Worker 1

Factor	Value (%)
Power Expended (Lightweight)	8
Work Stance (Standing On 2 Feet)	2.5
Work Movement (Normal)	0
Eye Fatigue (Almost Constant Vision)	6
Workplace Temperature (High)	22.5
Atmosphere Conditions (Good)	0
Environmental Conditions (Very Noisy)	5
Personal Needs	1
Total	45

Source: Analysis Results

Standard Time (WB) $= WN + (Allowance \times WN)$

$= 55.297 + (45\% \times 55.297)$

$= 80{,}180\ ^{minute}/_{m^2}$

Table 13 below shows the results of the calculation of standard time for all lightweight brick masonry workers.

Table 13. Standard Time Calculation Results

Factor	Value							
	Worker 1	Worker 2	Worker 3	Worker 4	Worker 5	Worker 6	Worker 7	Worker 8
Power Expended	8	8	8	8	8	8	8	8
Work Stance	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Work Movement	0	0	0	0	0	0	0	0
Eye Fatigue	6	7.5	6	6	7.5	6	6	7.5
Workplace Temperature	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Atmosphere Conditions	0	0	0	0	0	0	0	0
Environmental Conditions	5	5	5	5	5	5	5	5
Personal Needs	1	1	1	1	1	1	1	1
Total (%)	0.45	0.465	0.45	0.45	0.465	0.45	0.45	0.465
Normal Time	55.29	47.560	52.79	48.61	50.280	46.11	53.76	47.340
Standard Time	80.18	69.670	76.56	70.48	73.660	66.86	77.95	69.360

Source: Analysis Results

From the results of the standard time in Table 13 above, it can be seen that worker 1 has the largest value of 80,18 minutes/m^2, with a total allowance factor value of 45%. These allowance factors also play a role in determining the productivity outcomes of workers each day. This is because distractions during the work period can affect their overall performance. The value of eye fatigue can be different because some workers have almost continuous work focus, while others have continuous work focus and fixed focus.

Productivity

For example, the calculation of selected worker 1 with a productivity value for 1 day (8 working hours) from the calculation of standard time for the work sampling method with a value of 80.18 minutes/m² can be known by the following calculation:

Productivity $= \frac{60\ minute}{80{,}18\ ^{minute}/_{m^2}} = 0.748\ ^{m^2}/_{hour}$

The volume per day can be calculated as follows:

Productivity $= 0.748 \times 8\ hours = 5.987\ ^{m^2}/_{hour}$

The calculation results of the worker productivity value above can be seen in Table 14 below.

Table 14. Productivity Calculation Result

Workers	Hourly	Daily
Worker 1	0.748	5.987
Worker 2	0.861	6.889
Worker 3	0.784	6.270
Worker 4	0.851	6.810
Worker 5	0.815	6.516
Worker 6	0.897	7.179
Worker 7	0.770	6.158
Worker 8	0.865	6.921
Total	6.591	52.730

Source: Analysis Results

From Table 14 above, worker 6 recorded the highest work results with a productivity value of 7.179 m²/day, while worker 1 had the lowest results with a productivity value of 5.987 m²/day. During the observation period, the productivity value of the lightweight masonry workers in the Pakuwon Residence Bekasi Mixed Use Development project was 52.730 m²/day.

4. Conclusion

Based on the analysis and discussion using the work sampling method during the 10-day observation period, 8 lightweight masonry workers completed the work with a total area of 658.480 m2. They obtained a productivity value of 52.730 m2/day. In addition, from field observations, the level of adjustment factors and allowance factors can still be increased, with the hope that this increase will result in a significant increase in worker productivity in terms of time, quality, and quantity.

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