

LABOR PRODUCTIVITY RATING MODEL FOR LIGHT BRICK WALL INSTALLATION IN RESIDENTIAL PROJECTS

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ABSTRACT

Management on a construction project is something that cannot be ignored, because without construction management a project will be difficult to run according to expectations in the form of cost, time, quality and the success or failure of a construction project depends on the effectiveness of resource management. One way that can be done to achieve project objectives is to increase work productivity. This study aims to determine the productivity of labor in the installation of lightweight brick walls based on facts in housing projects. Labor productivity by analyzing the LUR value and productivity rating then becomes the regression analysis data to produce the model. The data search was carried out by direct observation to the field and conducting unstructured interviews with workers in the field. The resource persons are workers as artisans and workers who are experts in the work of installing light brick walls. This productivity measurement uses the productivity rating method, where worker activities are classified into 3 things, namely Essential contributory work, Effective work, and not useful. The results of the analysis show that the productivity of light brick wall installation workers based on the fact has higher productivity than the SNI labor coefficient. To calculate the labor productivity of installing lightweight brick walls, then the model from the results of this study can be used. The results of the evaluation of the model to predict labor productivity for installing lightweight brick walls have an average accuracy of 99.34%, so the model can be declared accurate.

Key word: model; productivity rating; labor productivity; construction management.

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INTRODUCTION

A construction project is a series that is carried out only once and is generally short-term (Rudi Waluyo; Subrata Aditama, 2017). In this series of activities, there is a process of processing project resources into a result of activities in the form of buildings (Paikun, Kadri, and Hudayani Sugara, 2018). The success or failure of a construction project depends on the effectiveness of resource management (Prayogo, 2017). Resources used during the construction process are materials, machines, man, method, money (Wulfram I. Ervianto, 2008).

One way that can be done to achieve project goals is to increase work productivity (Siswadi, 2017). Productivity is defined as the ratio of output to input (Tannady et al., 2019), but the reality on the ground is that it is sometimes difficult to obtain an ideal productivity value in construction work, as is the productivity of the labor force in installing light brick walls, because it is often found that the activities of the craftsmen not relevant to work, such as sitting idle, talking, smoking, eating and even sleeping during working hours. As a result, work becomes late and does not match the specified time, the duration of the project increases, and it affects the increase in the budget for paying labor wages (Huqban, Paikun, and Suhendi, 2020). One approach to determine the level of labor productivity is to use a method that classifies worker activities (Muslim, Z, and Lubis, 2019). In this study, observations were made using the productivity rating method, where worker activities were classified into 3 things, namely Essential contributory work, Effective work, and Not Useful (ineffective work).

From this background, the author will conduct research on labor productivity based on the level of effectiveness at work (labor utilization rate) in completing the work of wall pairs and wall

plastering so that a project can run effectively by maximizing the performance of its workforce (Nugroho et al., 2020). As a case sampling, the object of this research was the Bella Negara Tugu Regency-Sukabumi housing development project, which focused on the work of installing lightweight brick walls and plastering walls.

Supervision of building construction shows the quality of the buildings being built. The tighter the supervision, the higher the quality of the buildings made. The manufacture of this building uses quality materials and requires special skills (Marguna.A, et.al, 2020; Marwahyudi.M, 2020; Sabariah.I, et.al,2012).

Research Problem

1. What is the level of labor productivity in the Bella Negara Tugu Regency Housing development project, Sukabumi, West Java ?
2. How to estimate labor productivity model for light brick wall installation.

Research purposes

1. To find out how big the level of labor productivity in the Bella Negara Tugu Regency Housing development project, Sukabumi, West Java.
2. To produce an estimation model of labor productivity for installing lightweight brick walls.

Benefits of research

1. To find out the productivity standards of artisans and workers in the installation of lightweight brick walls in residential construction projects.
2. After the labor productivity model is generated, calculating productivity becomes easy, fast and simple.

The results of this study are also expected to provide input for contractors, especially on projects that are the object of research to increase labor productivity and are expected to be useful as a reference for construction service entrepreneurs, that professional workers have high productivity. A further benefit to science is that it is easy to calculate labor productivity using the model.

RESEARCH METHODS

This research was conducted on the housing project of PT. Restu Guna Usaha which is located at Jl. Raya Sukaraja Number 113 Sukaraja Village, Sukaraja District, Sukabumi Regency. This research is supported by quantitative methods, which will combine LUR calculations with work productivity calculations to identify wall installation and wall plastering work. After that, a regression analysis was carried out to produce an estimation model of labor productivity for installing lightweight brick walls. Furthermore, the model is tested for validity to determine its accuracy. In summary, the research method is illustrated in Figure 1.

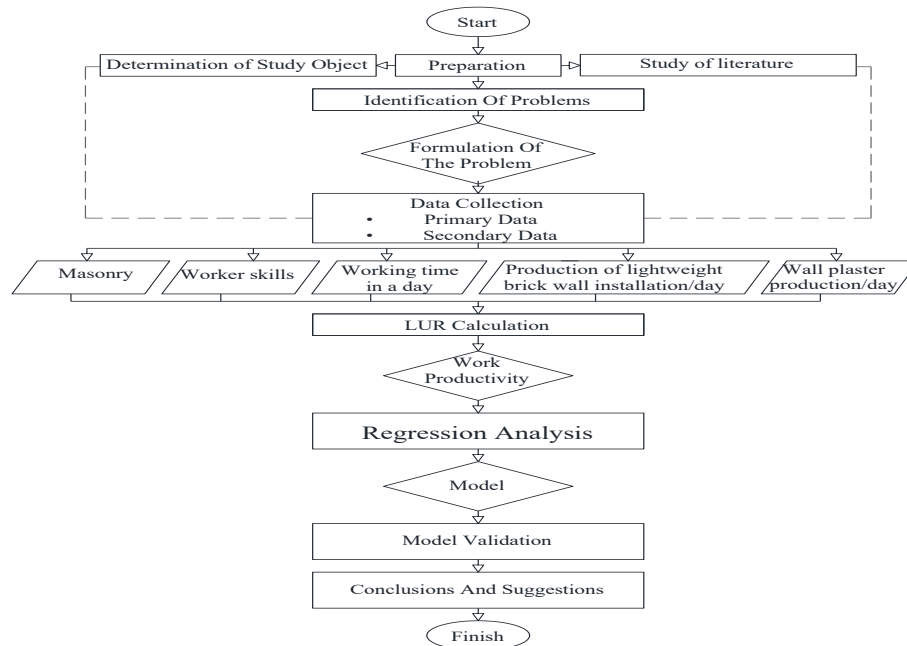


Figure 1. Research Flowchart

RESULTS AND DISCUSSION

LUR analysis

The calculation of LUR for wall masonry and wall plastering is done by recapitulating the overall data first the number of effective, contributive, and ineffective work, which will then be entered into the LUR formula or worker utility factor. The definitions of effective, contributive, and ineffective time are as follows:

1. Effective time: the working time used by the mason for the laying of lightweight bricks effectively is non-stop.
2. Contributive time: the time when the handyman reads drawings, receives work instructions, picks up work-related equipment, discusses work, waits without working.
3. Ineffective time = leaving the work zone during working hours, going to the toilet, sitting smoking, chatting unrelated to work.

The results of observing the effectiveness of labor for installing lightweight brick walls in a few days with 20 teams of workers are shown in Table 1-2.

Table 1. 1st-day wall installation labor LUR value

Days to-	Description	Effective	Contributive	Ineffective	Labor Utility Factor (LUR)%
		(minute)	(minute)	(minute)	
1	Craftsman I	352	97	31	78,39%
	Craftsman II	342	94	44	76,15%
	Workers	359	83	38	79,11%
.....
19	Craftsman I	354	87	39	78,28%
	Craftsman II	355	89	36	78,59%
	Workers	359	82	39	79,06%
20	Craftsman I	353	92	35	78,33%
	Craftsman II	358	90	32	79,27%
	Workers	360	85	35	79,43%

How to calculate LUR (Labor Utility Factor) as shown in Table 1, is done using equation 1 as follows:

$$LUR = \frac{\text{Effective time} + (\frac{1}{4} \text{ contributing time})}{\text{Total time of observation}} \times 100 \% \quad (1)$$

$$\begin{aligned} \text{Total time of observation} &= \text{Effective time} + \text{contributing time} + \text{ineffective time} \\ &= 352 + 97 + 31 \end{aligned}$$

= 480 minutes

$$\begin{aligned} \text{The utility factor of a handyman I in wall installation on day 1} &= \frac{352 + (\frac{1}{4} \times 97)}{480} \times 100\% \\ &= 78,39\% \end{aligned}$$

So, it was found that the utility factor of the Tukang workers on day 1 was 78.39% reaching an effective or satisfactory time because the utility factor of the workers was more than 50%. The results of observing the effectiveness of light brick wall plastering workers in a few days with 20 labor teams are shown in Table 2.

Table 2. LUR value of wall plastering work on day 1

Days to-	Description	Effective	Contributive	Ineffective	Labor Utility Factor (LUR)%
		(minute)	(minute)	(minute)	
1	Craftsman I	358	102	20	79,90%
	Craftsman II	352	97	31	78,39%
	Workers	365	87	28	80,57%
....
19	Craftsman I	361	93	26	80,05%
	Craftsman II	358	86	36	79,06%
	Workers	366	74	40	80,10%
20	Craftsman I	352	99	29	78,49%
	Craftsman II	365	82	33	80,31%
	Workers	368	74	38	80,52%

The analysis of LUR on craftsman I in Table 2 above is:

$$\begin{aligned} \text{Total time of observation} &= \text{Effective time} + \text{contributing time} + \text{ineffective time} \\ &= 352 + 97 + 31 \\ &= 480 \text{ minutes} \end{aligned}$$

$$\begin{aligned} \text{The utility factor of a handyman I in wall installation on day 1} &= \frac{358 + (\frac{1}{4} \times 102)}{480} \times 100\% \\ &= 79,90\% \end{aligned}$$

So, it was found that the utility factor of Tukang I workers on the 1st day of wall plastering work was 79.90% reaching an effective or satisfactory time because the utility factor of the workers was more than 50%. The analysis of the same LUR on craftsman and other workers and the following working days as exemplified above.

From the results of the analysis, it can be seen that the largest utility factor for wall pair workers (LUR) is carried out by a worker on the 11th day, which is 80.42%, while the smallest LUR value is carried out by a Craftsman II on the 10th day, which is 76.15%. The highest average LUR rate occurred on the 14th day, which was 79.83%, while the average LUR level was 78.90%. The biggest utility factor for plastering walls (LUR) was carried out by a worker on the 3rd day, which was 81.25%, while the smallest LUR value was carried out by an artisan I on the 3rd day, which was 77.08%. The highest average LUR level occurred on the 15th day, which was 80.07% with an average LUR rate of 79.64%.

Productivity

a. Light Brick Wall Installation

The installation of lightweight brick walls consisting of 2 builders and 1 worker with a sample number of 20 working days resulted in the installation of lightweight brick walls covering an area of 383.44 m². To calculate the average productivity produced by 2 craftsmen, the example is as follows:

The effective time of day 1 = (Craftsman I + Craftsman II) / 2
 = (352 + 342) / 2
 = 347 minutes = 5.78 hours

Average effective time = (5,78 + 5,94 + 5,88 + 5,93 + 6,01 + 5,86 + 5,84 + 5,94 + 5,88 + 5,78 + 5,94 + 5,85 + 5,92 + 5,99 + 5,86 + 5,95 + 5,95 + 5,88 + 5,91 + 5,93) / 20
 = 118,02 / 20 = 5.90 hours

Average productivity in m²/hour
 = Average total work output / Average effective time
 = 19,172 m² / 5.90 hours
 = 3.25 m²/hour

So, on average 2 craftsmen and 1 worker can do 3.25 m²/hour.

After calculating labor productivity, then the labor coefficient can be determined based on the facts with the following calculations:

Total production in 20 days = 383.44 m²
 Average = 383.44 / 20 or 19.172 m².

The results of the observations show that 2 craftsmen a day can do the installation of a light brick wall covering an area of 19,172 m²/day, then the result of 1 mason/day is 19,172 / 2 = 9.586 m², so the coefficient of mason m²/day is 1 / 9.586 = 0.104 Person/Day. To calculate the coefficient of workers a day on the installation of light brick walls, with the result of an area of 19,172 m²/day, then the installation of 1 m² is 1 / 19,172 = 0.052 worker days so that the installation of 1 m² takes 0.052 worker days. Based on the data obtained from this housing development project, one housing unit consists of a wall area of 115.02 m². Every day it is done by 2 builders with the help of 1 worker resulting in the installation of walls covering an area of 19,172 m²/day, so the installation of lightweight brick walls in 1 unit of the house can be completed in 5.99 = 6 days.

The labor coefficient for installing lightweight brick walls is then compared with the SNI coefficient as shown in Table 3.

Table 3. Comparison of the coefficient of light brick wall installation based on SNI and facts

Description	SNI coefficient		Fact coefficient
	unit	coefficient	coefficient
Workers	Person/Day	0,67	0,052
Bricklayer	Person/Day	1,300	0,104
Foreman	Person/Day	0,130	-

The results of the coefficient analysis as in Table 3, have a very significant difference in coefficient compared to the SNI coefficient and the fact coefficient, meaning that labor productivity based on facts can result in higher lightweight brick wall installation, but the note is that the fact coefficient is based on effective working time, has not added time tolerance is not effective.

Wall Plastering Works

The wall plastering work consists of 2 builders and 1 worker with a total sample of 20 working days resulting in a wall plastering area of 712.36 m². To calculate the average productivity produced by 2 workers in m²/hour, an example is given as follows:

Effective day 1 = (Craftsman I + Craftsman II) / 2
 = (358 + 352) / 2
 = 355 minutes = 5.92 hours

Average effective time = (5,92 + 5,97 + 5,87 + 5,98 + 6,00 + 5,87 + 5,94 + 6,01 + 6,02 + 5,91 + 5,94 + 5,98 + 5,88 + 5,98 + 6,01 + 5,89 + 6,02 + 6,01 + 5,99 + 5,98) / 20
 = 119,14 / 20 = 5.96 hours

So, the average effective working time of a handyman is 5.96 hours.

Average total work = (35,35 + 35,52 + 35,15 + 35,98 + 36,09 + 35,02 + 35,54 + 36,13 + 36,25 + 35,15 + 35,57 + 35,6 + 35,12 + 35,62 + 36,18 + 35,28 + 36,04 + 35,94 + 35,47 + 35,36) / 20

$$= 712,36 / 20 = 35,62 \text{ m}^2$$

Average productivity in m²/hour
= Average total work output / Average effective time
= 35.62 m²/ 5.96 hours
= 5,9 m²/hour

So, on average 2 craftsmen and 1 worker can do 5.96 m²/hour.

The coefficient analysis based on facts is explained as follows:

Total work = 712,36 m²
Average = 712,36 / 20 or 35,62 m²

The results of the performance of 2 craftsmen a day can work on wall plastering with an area of 35.62 m²/day, so the craftsmen working on plastering 1 m² can be calculated as 1 / 17.81 = 0.056 days, so the coefficient of craftsman / 1 m² is 0.056 days/person. For 1 worker a day can do wall plastering with an area of 35.62 m²/day, thus calculating the coefficient of workers in working on 1 m² of plastering is 1/35.62 or 0.028 days, then the coefficient of workers to work on 1 m² of lightweight brick wall plastering is 0.028 days/ person. Based on the data obtained from this housing development project, one house has a total area of 178.09 m² under review. If 35.62 m²/day of wall plaster can be produced every day, then wall plastering can be completed within 4.99 = 5 days. If the labor coefficient of 1 m² of SNI wall plaster is compared with the coefficient of the observations in this study, the productivity based on the observations is higher. The comparison of coefficients is clearly presented in Table 4.

Table 4. Comparison of lightweight brick wall plastering coefficients based on SNI and facts

Description	SNI coefficient		Fact coefficient
	unit	coefficient	coefficient
Workers	Person/Day	0,300	0,056
Bricklayer	Person/Day	0,15	0,028
Foreman	Person/Day	0,015	-

The worker coefficient based on SNI is 0.3 Person/Day, meaning that 1 working day is 1/3.3 or produces 3.33 m²/day wall plastering. The coefficient of craftsman based on SNI analysis is 0.15 Person/Day, meaning 1 day a worker can complete 1/0.15 or an area of 6.67 m²/day. Meanwhile, based on observations, workers produce 35.62 m²/day, and craftsmen produce 17.81 m²/day. Facts in the observation that 1 worker can serve 2 workers, while based on SNI Analysis 1 worker is served by 2 workers, so the SNI coefficient needs to be reviewed.

Statistical Analysis

Statistical analysis in this study was used to generate a model. The model that will be produced consists of 2 models, namely the productivity model of lightweight brick wall installation, and the productivity of lightweight brick wall plastering. The model that will be produced consists of 2 models, namely the productivity model of lightweight brick wall installation, and the productivity of lightweight brick wall plastering. The definition of the decision variable is determined that the area of light brick wall installation as the dependent variable 1 is stated Y1, and the area of plastering walls as the dependent variable 2 is stated Y2. The independent variables consist of a craftsman I, craftsman II, and workers then expressed in X1, X2, and X3. The model hypothesis in this statistical analysis consists of 2 models with equations 2-3.

$$\text{Productivity model of lightweight brick wall installation } Y1 = a + b_1.X_1 + b_2.X_2 + b_3.X_3 \quad (2)$$

$$\text{Productivity model of lightweight brick wall plastering } Y2 = a + b_1.X_1 + b_2.X_2 + b_3.X_3 \quad (3)$$

In this statistic, the independent variable is more than 1 variable, so to produce the model, multiple linear regression analysis is used.

Multiple Linear Regression Analysis

Multiple linear regression analysis was used to determine the effect of the effective time of handyman I (X1), handyman II (X2), and worker (X3) on productivity (Y) on wall installation and plastering of lightweight brick walls on housing projects. Data analysis is labor productivity data based on observations on research objects that have been analyzed based on LUR and productivity rating. The main data as the basis for multiple linear regression statistical analysis are presented in Table 5.

Table 5. Multiple Linear Regression Analysis Data

Light Brick Wall Installation					Lightweight Brick Wall Plaster			
Days to-	(X ₁)	(X ₂)	(X ₃)	(Y ₁)	(X ₁)	(X ₂)	(X ₃)	(Y ₂)
1	352	342	359	18.95	358	352	365	35.35
2	360	353	362	19.31	359	357	368	35.52
3	352	354	360	19.05	347	357	369	35.15
4	355	357	361	19.25	357	360	366	35.98
5	359	362	362	19.41	358	362	366	36.09
6	349	354	358	19.05	358	346	369	35.02
7	352	349	357	19.08	358	355	369	35.54
8	360	353	364	19.28	359	362	365	36.13
9	351	354	360	19.21	362	360	369	36.25
10	352	342	359	19.00	350	359	363	35.15
11	360	353	364	19.32	357	356	368	35.57
12	348	354	368	19.13	360	358	364	35.60
13	357	353	359	19.18	358	349	362	35.12
14	359	360	364	19.30	360	358	370	35.62
15	348	355	361	19.11	362	359	369	36.18
16	356	358	362	19.19	348	359	363	35.28
17	355	359	362	19.20	360	362	366	36.04
18	351	354	360	19.04	362	359	363	35.94
19	354	355	359	19.18	361	358	366	35.47
20	353	358	360	19.20	352	365	368	35.36

Based on the statistical analysis of multiple linear regression using a computer application, from the data presented in Table 5, the regression equation is as follows:

$$Y_1 = 6.302 + 0.018 X_1 + 0.011 X_2 + 0.008 X_3 \text{ for the light brick wall installation model.}$$

$$Y_2 = - 7,362 + 0,056 X_1 + 0,056 X_2 + 0,007 X_3 \text{ for light brick wall plastering model.}$$

This model is generated from statistical analysis of multiple linear regression in the coefficient analysis as described in Tables 6 and 7.

Table 6. The output of the analysis of the coefficients of the lightweight brick wall installation model as the basis for determining the model

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	6.302	1.740	3.622	0.002	2.613	9.991	2.613	9.991
X Variable 1	0.018	0.003	5.712	0.000	0.011	0.024	0.011	0.024
X Variable 2	0.011	0.003	4.264	0.001	0.005	0.016	0.005	0.016

X Variable 3	0.008	0.005	1.524	0.147	-0.003	0.018	-0.003	0.018
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Table 7. The output of the analysis of the coefficients of the lightweight brick wall plastering model as the basis for determining the model

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-7.362	8.302	-0.887	0.388	-24.961	10.238	-24.961	10.238
X Variable 1	0.056	0.010	5.396	0.000	0.034	0.078	0.034	0.078
X Variable 2	0.056	0.010	5.437	0.000	0.034	0.078	0.034	0.078
X Variable 3	0.007	0.019	0.392	0.700	-0.032	0.047	-0.032	0.047

The explanation of the regression model above is that the regression coefficient shows that the productivity of Y labor for lightweight brick masonry will increase by 0.018 and wall plastering by 0.056 in each additional unit of X1. The regression coefficient Y indicates that the labor (builders) in the installation of walls and plastering of lightweight brick walls will increase by 0.011 and 0.056 for each additional unit of X2. The regression coefficient Y indicates that the workforce (workers) in the installation of walls and plastering of lightweight brick walls will increase by 0.008 and 0.007 units for each additional one unit of X3.

Multiple Coefficient of Determination Test

The coefficient value of R Square is 0.850 for wall pairs and 0.778 for wall plastering, meaning that 85% of productivity can be explained by craftsmen I, II, and workers, and 78% productivity of lightweight brick wall plastering can also be explained by craftsmen I, II and workers. While the rest (100% - 85% = 15%) and (100% - 78% = 22%) are explained by reasons other than the model. The R Square value ranges from 0 to 1, with a note that the smaller the R Square number, the weaker the relationship between the independent variable and the dependent variable. The correlation coefficient is 0.922 for wall installation, and 0.88 for light brick wall plastering, so it can be concluded that the value obtained is classified as high correlation because it is close to 1.

F. test

This Anova test produces an F value of 30.322 for wall pairs and 18.716 for wall plastering with a significance level (probability number) of 0.000, because the probability number is 0.000 < from 0.05, then regression model is feasible to use to predict productivity. Based on the table values obtained, the regression analysis carried out is significant where the calculated F value is 30.332 and 18.716 > 3.20 F. table, then H0 is rejected while H1 is accepted. This means that X1, X2, and X3 affect the productivity of wall installation and red brick wall plastering produced.

T. test

The results of the t-test X1 with Y show that the t-value of X1 for wall installation and plastering of light brick walls is 5.712 and 5.396 > 2.100 t table, with Sig. = 0.000 < 0.05 so that the decision taken is H0 is rejected and H1 is accepted. The t-test X2 analysis results show that the t-count values for masonry and plastering of lightweight brick walls are 4.264 and 5,437 > 2,100 t table, with Sig. = 0.001 and 0.000 < 0.05 so that the decision taken is H0 is rejected and H1 is accepted. These results indicate that the variables X1 and X2 significantly affect the productivity variable. In the X3 t-test, the results of the analysis show that the t-count value for masonry and lightweight brick wall plastering is 1.524 < 2.100 t table and the probability value of the worker variable is Sig. = 0.147 and Sig. = 0.700 > 0.05, so the decision taken is H0 is accepted and H1 is rejected. These results indicate that the X3 variable has no significant effect on the productivity variable.

Model Validity Test

The model validity test is to test how accurate the calculation results are using a model with facts in the field (Paikun et al., 2019). This test can be done by comparing the calculation of productivity based on the field (AV) and also using the model (EV), then the difference value, standard error, and accuracy will be calculated as in Table 8.

Table 8. Model Validity Test

	Lightweight Brick Wall Pair					Lightweight Brick Wall Plaster				
	Model	factua l	Differ ence	Error (%)	Accurac y (%)	Model	factu al	Differ ence	Error (%)	Accur acy
	(Y)	(Y)		(EV- AV)/A V * 100%	100%- Error	(Y)	(Y)		(EV- AV)/AV * 100%	100%- Error
1	18,989	18,95	0,039	0,21%	99,79%	35,329	35,02	0,309	0,88%	99,12%
2	19,273	19	0,273	1,44%	98,56%	35,689	35,12	0,569	1,62%	98,38%
3	19,126	19,04	0,086	0,45%	99,55%	35,02	35,15	-0,13	-0,37%	99,63%
4	19,22	19,05	0,17	0,89%	99,11%	35,731	35,15	0,581	1,65%	98,35%
5	19,353	19,05	0,303	1,59%	98,41%	35,9	35,28	0,62	1,76%	98,24%
6	19,058	19,08	-0,022	-0,12%	99,88%	35,02	35,35	-0,33	-0,93%	99,07%
7	19,049	19,11	-0,061	-0,32%	99,68%	35,527	35,36	0,167	0,47%	99,53%
8	19,288	19,13	0,158	0,83%	99,17%	35,949	35,47	0,479	1,35%	98,65%
9	19,109	19,18	-0,071	-0,37%	99,63%	36,034	35,52	0,514	1,45%	98,55%
10	18,989	19,18	-0,191	-1,00%	99,00%	35,258	35,54	-0,282	-0,79%	99,21%
11	19,288	19,19	0,098	0,51%	99,49%	35,52	35,57	-0,05	-0,14%	99,86%
12	19,116	19,2	-0,084	-0,44%	99,56%	35,772	35,6	0,172	0,48%	99,52%
13	19,197	19,2	-0,003	-0,02%	99,98%	35,138	35,62	-0,482	-1,35%	98,65%
14	19,346	19,21	0,136	0,71%	99,29%	35,816	35,94	-0,124	-0,35%	99,65%
15	19,074	19,25	-0,176	-0,91%	99,09%	35,978	35,98	-0,002	-0,01%	99,99%
16	19,256	19,28	-0,024	-0,12%	99,88%	35,145	36,04	-0,895	-2,48%	97,52%
17	19,249	19,3	-0,051	-0,26%	99,74%	36,012	36,09	-0,078	-0,22%	99,78%
18	19,109	19,31	-0,201	-1,04%	98,96%	35,934	36,13	-0,196	-0,54%	99,46%
19	19,165	19,32	-0,155	-0,80%	99,20%	35,843	36,18	-0,337	-0,93%	99,07%
20	19,187	19,41	-0,223	-1,15%	98,85%	35,745	36,25	-0,505	-1,39%	98,61%
	average value			0,66%	99,34%	average value			0,96%	99,04%

In Table 8, the standard error values for light brick wall installation work are 0.66%, wall plastering is 0.96% and the accuracy for lightweight brick walls is 99.34%, light brick wall plaster is 99.04%, so it can be concluded that the model accurate enough to use.

Result Recapitulation

The Work Utility Value (LUR) for masonry and light brick wall plastering is in the satisfactory category because the utility factor of the workers is more than 50% with an average LUR level of 78.90 for masonry and 79.64% for plastering of light brick walls. The productivity produced for lightweight masonry walls carried out by 2 craftsmen and 1 worker can produce an average of 3.25 m²/hour, and for plastering lightweight brick walls it produces an average of 5.96 m²/hour. The coefficient of light brick wall installation work based on facts in the field has a worker coefficient of 0.052 Persons/Day, and an artisan coefficient of 0.104 Persons/Day, while based on SNI the coefficient of labor is 0.67 Persons/Day and a handyman coefficient of 1,300 Persons/Day. The coefficient of light brick plastering work based on facts in the field has a worker coefficient of 0.028 Person/Day, and a handyman coefficient of 0.056 Person/Day, while based on SNI analysis, the worker coefficient is 0.300 Person/Day, and the artisan coefficient is 0.15 Person/Day.

The estimation model of labor productivity for masonry and plastering of lightweight brick walls is $Y_1 = 6.302 + 0.018X_1 + 0.011X_2 + 0.008X_3$ for the productivity of installing lightweight brick walls, and $Y_2 = - 7.362 + 0.056X_1 + 0.056X_2 + 0.007X_3$ for the productivity of plastering work light brick wall. The standard error value for light brick wall installation work is 0.66%, and 0.96% for light brick wall plastering work. The accuracy of the lightweight brick wall installation productivity model is 99.43%, and 99.04% for lightweight brick wall plastering work productivity, so it can be concluded that this model is quite accurate to use.

CONCLUSION

This research has identified the level of labor productivity for installing lightweight brick walls and labor productivity for plastering lightweight brick walls in residential construction projects. Labor productivity based on observation and analysis, for workers who use their working time well and in a satisfactory category, can produce wall installation and plastering of lightweight brick walls which are much higher than the standard of SNI analysis. Labor productivity of lightweight brick wall installation and lightweight brick wall plastering in this study has been analyzed and produced a craftsman coefficient and worker coefficient, this coefficient can be used as a reference to review the SNI analysis coefficients specifically for lightweight brick wall installation and lightweight brick wall plastering. To calculate the productivity of labor in the installation of walls and plastering of lightweight brick walls can then use the labor productivity model that has been produced in this study. The labor productivity model specifically for wall installation and lightweight brick wall plastering has been validated and declared accurate because it only has an error below 1%. This model can be used to calculate the productivity of the workforce in working every day easily and simply. From now on, contractors or individuals who employ workers for wall installation and plastering of lightweight brick walls can determine the minimum standard of output every working day for the workers they employ by estimates using the model.

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