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Analysis of The Productivity Levels of Labor in Beam and Plate Structure Word in The Myze Sumenep Hotel Project

*M. Rafi[1] and Oetomo, Wateno[2]

[12]Faculty of Engineering, University of 17 Agustus 1945 Surabaya, Indonesia
*mrafi0657@gmail.com[1]

Abstract

In a construction project, the productivity of the workforce is one of the fundamental factors that plays an important role in the project's success. Lower productivity increases the likelihood of work delays, whereas higher productivity reduces the chances of delays. The purpose of this study is to determine the productivity levels, labour coefficients, and productivity levels based on Labour Utilization Rate (LUR) for the beam and floor slab work in the Myze Sumenep Hotel Project. The method used in this study involved observation and work sampling methods, employing a productivity rating approach. The research findings indicate that the formwork work group has the highest productivity level in the field, with an average of 5,118 m^2/person. The productivity levels for beam iron work, plate iron work, and casting work are 86,461 kg/person, 245,064 kg/person, and 7,364 m^3/person, respectively. The work calm coefficient for formwork work is found to be 0,019 OH for foremen, 0,096 OH for builders, and 0,096 OH for workers. For beam iron work, the coefficients are 0,001 OH for foremen, 0,005 OH for carpenters, and 0,005 OH for workers. The coefficients for plate iron work are 0,005 OH for foremen, 0,002 OH for carpenters, and 0,002 OH for workers. Finally, for casting work, the coefficients are 0,014 OH for foremen, 0,041 OH for builders, and 0,081 OH for workers. Based on the worker utility factor (LUR) for beam and slab formwork, the average LUR productivity is 82,84%. Beam ironing work has an average LUR of 86,75%, plate iron work has an average LUR of 86,83%, and foundry work has an average LUR of 69,59%. Therefore, the productivity levels are deemed satisfactory as they exceeded 50%.

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1. Introduction

MYZE Sumenep Hotel Project is located on Jl. Arya Wiraraya, Gedung Timur, Batuan District, Sumenep Regency, East Java 6945 This project is the most extensive hotel development in Madura. Several different floors are planned for this development. In a field survey already in the construction stage.

One of the activities that affect the progress of construction projects is construction work, especially the reinforcement of beams and slabs. This work is an essential form of construction for the operation of the whole project. In order to continue the work according to the planned scope and time, workers must be highly productive to have a positive impact at the end of the work. To do that, we need a metric that serves as a benchmark for service providers and users. This study aimed to determine the value of the level of productivity, the coefficient, and the number of jobs for beam and plate work.

2. Material and Methods

2.1 Theoretical Framework

This study aims to analyse the magnitude of productivity levels and the magnitude of the labour productivity coefficient during the operation of the Myze Hotel project in Gudungan Timur Village, Batuan District, Sumenep City, East Java. In this study, the work sampling method is used for data processing.

Working volume data and Lur data, photographic documentation of field conditions. Labour productivity levels are later determined from this product data. It is calculated using the work extraction method and calculated as a percentage using Labour Utilization Ratio (LUR). The process of research in this study is presented in Figure 1.

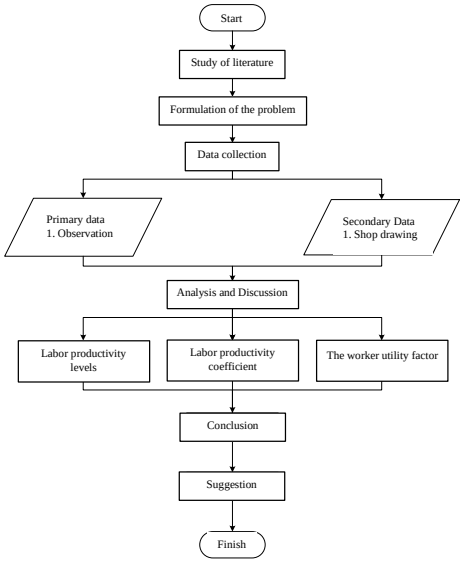

Figure. 1 Flowchart

This study uses a labour sample aimed at optimizing labour productivity. This method is labour productivity activity modelled as a daily average volume, a daily factor, and a percentage of time so that it can be used to achieve a specific goal. This study aims to analyse yield, coefficient magnitude, and productivity level based on LUR.

2.2 Research Location

The research is located in the myze hotel sumenep development project. This project is carried out in Gedungan village, Batuan district, Sumenep regency, Jawa Barat.

Figure 2. Research Locations

2.3 Data

The data used in this research are primary and secondary. Primary data is from direct observation, such as daily work volume, number of workers, effective, ineffective, and contributing working time. While secondary data is data obtained from the company's point of view, such as working drawings

2.4 Analysis Method

2.4.1 Productivity Scale Analysis

Productivity is the value from a ratio of output and input. Output is the number of results obtained from the work process within the allotted time. In this case, it is the volume of work. Input is capital or resources expended in the work process. In this case, it is the number of workers or people. The productivity is used by this following formula :

$$P = \frac{O}{I}$$

P is the value of productivity, O is output, and I is input.

2.4.2 Labour Coefficient

Labour coefficient is the ratio of labour input to output. The value is expressed as the labour time required to produce a specific output unit. The underlying assumption is that labor is the primary factor of production and that its contribution to the production process can be quantified.

Productivity Coefficient $= \frac{Labour\ Input}{Labour\ Output}$

2.4.3 Labour Utilization Rate (LUR)

Labour utilization rate is expressed as a percentage. It indicates the proportion of available labour hours that is effectively utilized on construction project. The value of LUR is used to determine the effectiveness or productive of the worker in construction project.

$$LUR = \frac{Effective\ time + \frac{1}{4} Contribution\ time}{Total\ observation} \times 100\%,$$

3. Result and Discussion

3.1 Calculation of Labour Productivity

The labour productivity calculation consists of beam and plate formwork, beam reinforcement work, plate reinforcement work, and beam & plate casting work. Productivity is calculated using work volume and number of workers.

The productivity working group is calculated after obtaining the results of observations in the form of the number of workers, volume of work, and time of execution of work. The calculation is carried out from day 1 until day 9.

$$P_1 = \frac{Total\ Labour\ Input}{Labour\ Output}$$

$$= \frac{46,82}{11} = 4,256\ m^2/man$$

The next day is calculated with same formula and different work. The results are presented in Table 1, Table 2, Table 3, and Table 4.

Table 1. Results of Productivity Analysis of Beam and Plate Formwork

Day	Work Volume	Duration	Number of People			Average People
	m	hour	Foreman	Craftsman	Worker	
1	46,82	8	1	5	5	4,256
2	47,19	8	1	5	5	4,290
3	78,17	8	1	5	5	7,106
4	40,99	8	1	5	5	3,726
5	51,88	8	1	5	5	4,716
6	67,57	8	1	5	5	6,143
7	49,16	8	1	5	5	4,469
8	37,79	8	1	5	5	3,436
9	87,17	8	1	5	5	7,924
Daily Average	56,30	8,00	1,00	5,00	5,00	5,118

Table 2. Results of Productivity Analysis of Beam Reinforcement Work

Day	Work Volume	Duration	Number of People			Average People
	kg	hour	Foreman	Craftsman	Worker	
1	934,20	8	1	5	5	84,927
2	898,65	8	1	5	5	81,695
3	1020,38	8	1	5	5	92,762
Daily Average	951,08	8,00	1,00	5,00	5,00	86,46

Table 3. Results of Productivity Analysis of Plate Reinforcement Work

Day	Work Volume	Duration	Number of People			Average People
	kg	hour	Foreman	Craftsman	Worker	
1	2555,020	8	1	4	4	283,891
2	2580,881	8	1	4	4	286,765
3	1311,191	8	1	4	4	145,688
4	2375,220	8	1	4	4	263,913
Daily Average	2205,578	8	1	4	4	245,064

Table 4. Results of Productivity Analysis of Beam and Plate Casting

Day	Work Volume	Duration	Number of People			Average People
	kg	hour	Foreman	Craftsman	Worker	
1	73,645	8	1	3	6	7,3645

3.2 Calculation of Labour Productivity Coefficient

Labour productivity coefficient is calculated using number of people and the value of work volume. The coefficient is gotten from the ratio of total labour input to labour output. The calculation is carried out for foreman, craftsman, and worker in 9 days. The results of all coefficient is presented in Table 5, Table 6, Table 7, and Table 8.

- Foreman

  Productivity Coefficient $= \frac{Labour\ Input}{Labour\ Output}$

  $= \frac{1}{46,82}$

  = 0,021 OH

- Craftsman

  Productivity Coefficient $= \frac{Labour\ Input}{Labour\ Output}$

  $= \frac{5}{46,82}$

  = 0,107 OH

- Worker

  Productivity Coefficient $= \frac{Labour\ Input}{Labour\ Output}$

  $= \frac{5}{46,82}$

  = 0,107 OH

Table 5. The Results of The Labour Coefficient in Beam and Plate Formwork Work

Day	Work Volume	Duration	Number of People		
	kg	hour	Foreman	Craftsman	Worker
1	46,82	8	0,021	0,107	0,107
2	47,19	8	0,021	0,106	0,106
3	78,17	8	0,013	0,064	0,064
4	40,99	8	0,024	0,122	0,122
5	51,88	8	0,019	0,096	0,096
6	67,57	8	0,015	0,074	0,074
7	49,16	8	0,020	0,102	0,102
8	37,79	8	0,026	0,132	0,132
9	87,17	8	0,011	0,057	0,057
Daily Average	56,30	8	0,019	0,096	0,096

Table. 6 The Results of The Labour Coefficient in Beam Reinforcement Work

Day	Work Volume	Duration	Number of People		
	kg	hour	Foreman	Craftsman	Worker
1	934,2	8	0,001	0,005	0,005
2	898,65	8	0,001	0,006	0,006
3	1020,38	8	0,001	0,005	0,005
Daily Average	951,077	8	0,001	0,005	0,005

Table 7. The Results of The Coefficient Labour in Plate Reinforcement Work

Day	Work Volume	Duration	Number of People		
	kg	hour	Foreman	Craftsman	Worker
1	2555,02	8	0,0004	0,0016	0,0016
2	2580,881	8	0,0004	0,0015	0,0015
3	1311,191	8	0,0008	0,0031	0,0031
4	2375,22	8	0,0004	0,0017	0,0017
Daily Average	2205,578	8	0,0005	0,0020	0,0020

Table 8. The Results of The Coefficient Labour in Beam and Plate Casting Work

Day	Work Volume	Duration	Number of People		
	kg	hour	Foreman	Craftsman	Worker
1	73,645	8	0,014	0,041	0,081

3.3 Analysis of Worker Productivity Using LUR

In calculating worker productivity with labour utilization rate, it is necessary to observe the value of total adequate time, contribution time, ineffective time, and total observation time. The calculation is carried out for all labour.

$$LUR_1 = \frac{Effective\ time + \frac{1}{4} Contribution\ time}{Total\ observation} \times 100\%$$

$$= \frac{370 + \frac{1}{4} 60}{480} \times 100\%$$

$$= 89{,}64\ \%$$

The results of calculation is presented in Table 9, Table 10, Table 11, Table 12, Table 13, Table 14, and Table 15. From Table 9, It is known that the percentage of labour utility factor 1 in formwork work is 89,64%. Based on the theory, these results are quite satisfactory because the value of the utility factor is more excellent than 50%. The results of utility calculations can then be seen in the recapitulation value of labour LUR at ironing work in Table 10.

Table 9. The Analysis of LUR on the 1st Day of Beam and Plate Formwork Work

Labour	Amount of Effective Working Time	Amount of Ineffective Working Time	Amount of Contribution Working Time	Amount of Observation	LUR
	(minute)	(minute)	(minute)		
Person 1	370	50	60	480	89,64%
Person 2	385	65	30	480	86,51%
Person 3	394	60	26	480	87,55%
Person 4	380	80	20	480	83,39%
Person 5	372	72	36	480	85,05%
Person 6	381	63	36	480	86,93%
Person 7	388	57	35	480	88,18%
Person 8	413	45	22	480	90,68%
Person 9	370	90	20	480	81,30%
Person 10	382	72	26	480	85,05%
Person 11	380	68	32	480	85,89%

Table 10. The Recapitulation of LUR of Beams and Plate Formwork Work for 9 Days

Labour	LUR 1	LUR 2	LUR 3	LUR 4	LUR 5	LUR 6	LUR 7	LUR 8	LUR 9	Average LUR
Person 1	89,64%	82,55%	84,22%	82,76%	80,26%	85,68%	88,59%	90,68%	92,34%	86,30%
Person 2	86,51%	88,39%	73,39%	80,26%	92,76%	84,43%	90,47%	92,55%	90,47%	86,58%
Person 3	87,55%	83,80%	75,89%	76,09%	85,89%	83,80%	81,93%	84,22%	88,18%	83,04%
Person 4	83,39%	85,05%	81,93%	80,05%	83,59%	81,51%	80,05%	77,34%	77,97%	81,21%
Person 5	85,05%	86,30%	76,72%	76,51%	76,72%	77,14%	76,51%	85,68%	87,76%	80,93%
Person 6	86,93%	88,59%	82,55%	80,89%	85,47%	85,68%	86,51%	83,39%	89,64%	85,52%
Person 7	88,18%	88,39%	74,22%	75,89%	76,09%	75,68%	76,72%	87,97%	85,89%	81,00%
Person 8	90,68%	81,51%	85,47%	85,26%	85,89%	86,93%	92,55%	85,47%	84,64%	86,49%
Person 9	81,30%	75,05%	81,51%	73,59%	79,84%	81,93%	84,22%	85,26%	84,22%	80,77%
Person 10	85,05%	76,72%	73,59%	80,47%	77,55%	78,18%	76,09%	78,59%	75,47%	77,97%
Person 11	85,89%	79,64%	77,55%	76,09%	79,64%	81,72%	85,89%	84,43%	82,34%	81,47%
Daily Average	**86,38%**	**83,27%**	**78,82%**	**78,90%**	**82,15%**	**82,06%**	**83,59%**	**85,05%**	**85,36%**	**82,84%**

Table 11. The Analysis of LUR on the 1st Day of Beam Reinforcement Work

Labour	Amount of Effective Working Time	Amount of Ineffective Working Time	Amount of Contribution Working Time	Amount of Observation	LUR
	(minute)	(minute)	(minute)		
Person 1	352	59	69	480	87,76%
Person 2	373	81	26	480	83,18%
Person 3	385	61	34	480	87,34%
Person 4	396	53	31	480	89,01%
Person 5	387	67	26	480	86,09%
Person 6	398	46	36	480	90,47%
Person 7	381	78	21	480	83,80%
Person 8	405	55	20	480	88,59%
Person 9	376	65	39	480	86,51%
Person 10	384	73	23	480	84,94%
Person 11	402	53	25	480	89,01%

Table 12. The Recapitulation of LUR of Beams Reinforcement Work for 3 Days

Labour	LUR 1	LUR 2	LUR 3	Average LUR
Person 1	87,76%	87,34%	89,43%	88,18%
Person 2	83,18%	84,22%	86,09%	84,50%
Person 3	87,34%	88,39%	86,51%	87,41%
Person 4	89,01%	85,68%	87,76%	87,48%
Person 5	86,09%	84,64%	83,59%	84,77%
Person 6	90,47%	89,43%	87,97%	89,29%
Person 7	83,80%	85,89%	85,47%	85,05%
Person 8	88,59%	90,05%	88,59%	89,08%
Person 9	86,51%	86,09%	86,30%	86,30%
Person 10	84,94%	83,59%	85,26%	84,60%
Person 11	89,01%	87,14%	86,72%	87,62%
Daily Average	**86,97%**	**86,59%**	**86,70%**	**86,75%**

Table 13. The Analysis of LUR on the 1st Day of Plate Reinforcement Work

Labour	Amount of Effective Working Time	Amount of Ineffective Working Time	Amount of Contribution Working Time	Amount of Observation	LUR
	(minute)	(minute)	(minute)		
Person 1	347	48	85	480	90,05%
Person 2	398	55	27	480	88,59%
Person 3	405	41	34	480	91,51%
Person 4	378	64	38	480	86,72%
Person 5	384	71	25	480	85,26%
Person 6	385	57	38	480	88,18%
Person 7	388	64	28	480	86,72%
Person 8	372	86	22	480	82,14%
Person 9	395	59	26	480	87,76%

Table 14. The Recapitulation of LUR of Beams Reinforcement Work for 4 Days

Labour	LUR 1	LUR 2	LUR 3	LUR 4	Average LUR
Person 1	90,05%	87,14%	90,05%	88,39%	88,91%
Person 2	88,59%	86,51%	88,59%	86,93%	87,66%
Person 3	91,51%	84,64%	91,51%	88,80%	89,12%
Person 4	86,72%	87,55%	86,72%	84,22%	86,30%
Person 5	85,26%	85,05%	85,26%	85,89%	85,37%
Person 6	88,18%	82,14%	88,18%	82,34%	85,21%
Person 7	86,72%	83,59%	86,72%	88,80%	86,46%
Person 8	82,14%	86,93%	82,14%	89,84%	85,26%
Person 9	87,76%	88,80%	87,76%	84,64%	87,24%
Daily Average	**87,44%**	**85,82%**	**87,44%**	**86,65%**	**86,84%**

Table 15. The Analysis of LUR on the 1st Day of Beam and Plates Casting Work

Labour	Amount of Effective Working Time (minute)	Amount of Ineffective Working Time (minute)	Amount of Contribution Working Time (minute)	Amount of Observation	LUR
Person 1	320	20	20	360	70,89%
Person 2	313	32	15	360	68,39%
Person 3	322	28	10	360	69,22%
Person 4	312	35	13	360	67,76%
Person 5	321	22	17	360	70,47%
Person 6	303	29	28	360	69,01%
Person 7	307	30	23	360	68,80%
Person 8	334	15	11	360	71,93%
Person 9	324	26	10	360	69,64%
Person 10	315	25	20	360	69,84%

Table 16. The Recapitulation of LUR of Beam and Plate Casting Work

Labour	LUR 1	Average LUR
Person 1	70,89%	70,89%
Person 2	68,39%	68,39%
Person 3	69,22%	69,22%
Person 4	67,76%	67,76%
Person 5	70,47%	70,47%
Person 6	69,01%	69,01%
Person 7	68,80%	68,80%
Person 8	71,93%	71,93%
Person 9	69,64%	69,64%
Person 10	69,84%	69,84%
Daily Average	**69,60%**	**69,60%**

4. Conclusion

Based on the calculations that have been conducted, it can be concluded that, Firstly, the productivity levels of work groups in the field were calculated and determined. The average productivity for formwork was 5,118 m^2/person, while iron beam work had an average of 86,461 kg/person. For plate irons, the average productivity was 245,064 kg/person, and the average casting work was 7,365 m^3/person.

Secondly, work factors were analyzed and derived from the calculations. The polishing factor for formwork was found to be 0,019 OH on average, while masonry and workers had a factor of 0,096 OH each. In the case of ironwork, foremen had an average coefficient of 0,001 OH, carpenters had 0,005 OH, and workers had 0,005 OH. For sheet metal work, the average coefficients were 0,0005 OH for foremen, 0,002 OH for carpenters, and 0,002 OH for laborers. Lastly, in foundry work, the average coefficients were determined as 0,014 OH for foremen, 0,041 OH for masons, and 0,081 OH for laborers.

Finally, the research results indicated the average LUR productivity of utility factors. The beam and slab formwork workers had an average utility factor (LUR) of 82,84%. Sheet metal work had an average hanger utility factor of 86,75%, and the cast work had an average of 69,59% with a utility factor of 86,83. These productivity levels were considered satisfactory as they exceeded the 50% benchmark, emphasizing the development of alternative flood management scenarios.

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6. Author's Note

I, at this moment, declare that the article entitled " Analysis of The Productivity Levels of Labor in Beam and Plate Structure Word in The Myze Sumenep Hotel Project" is an original work and has been defended in the examination to obtain a Bachelor's degree in Civil Engineering at the Civil Engineering Study Program, Faculty of Engineering, Universitas 17 Agustus 1945 Surabaya

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