

## **Research Article**

# **Measurement of Productivity Using Work Sampling Method at Menara Sentraya building Project Jakarta Indonesia**

**Atfal Murodif<sup>1</sup>, Erizal<sup>2</sup>, Meiske Widyarti<sup>3</sup>**

<sup>1</sup>Postgraduate of Civil, <sup>2,3</sup>Lecturer of Civil, Dept of Civil and Environmental Engineering, Bogor Agricultural University (IPB), Bogor, Indonesia

### **\*Corresponding author**

Atfal Murodif

Email: [atfal1969@gmail.com](mailto:atfal1969@gmail.com)

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**Abstract:** Construction management should be able to know some ways to measure workers productivity before making an effort to improve productivity. Productivity is one of the most important issues in both developed and developing building construction. The research objective were to analyze labor productivity by using work sampling method, It is used to obtain Labor Utilization Rate (LUR) value. The LUR analysis results of formwork, reinforcement, and concreting are 47.32%, 43.17%, and 49.76%. Total LUR of three work type is 45.60%. It is can concluded that the productivity is still relatively high.

**Keywords:** labor productivity, LUR, work sampling.

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## **INTRODUCTION**

Competition of construction services business in globalization era will be very strict. In addition to the presence of foreign contractors to domestic construction market, the transparency requirement as globalization's characteristic will be strengthened [1]. An overdue construction project was common to be found caused by the execution which were not in accordance with schedule agreed upon in contract. The delayed project was caused by several factors, such as the productivity level of existing workforce in construction project activities [2]. Worker productivity is one of main element in determining the successful execution of construction project, but the ineffective uses of labor, such as talking, eating, drinking, smoking outside recess were common to be found. Therefore, management should be able to know some ways to measure workers' productivity before making an effort to improve productivity [3].

## **RESEARCH METHOD**

### **Time and Place**

The research was conducted in July 2014 to September 2014, in Menara Sentraya Project, Jakarta, Indonesia. The research objective were to analyze labor productivity by using work sampling method

### **Tools and Materials**

This research used tools and materials which are: stop watch, camera, tape recorder, computer, shop drawing, finger print time attendance.

### **Procedure and Research Stage**

This research consisted are literature study and field study. They are books, journals, and internet. Measurement of labor productivity in construction sector was conducted using several approaches, which are: 1). Field rating, 2). Work sampling 3). Five-minute rating. [4] and [5]. Work sampling in general is an observation technique where a lot observation conducted quickly within a certain period of working group, machine or process [6]. Work sampling classified into three types of activities [7] and [5]: 1. Effective work (productive) is an activity which directly related to the construction process that contribute directly to final result. 2. Essential contributory work (semi-productive) is an activity that does not directly influence the outcome but generally required in running an operation. 3. Ineffective work (non-productive) is a worker's activity that is not directly related to the work performed. Work sampling conducted by observing an activity in short period, which is not suitable for observation in large group [5].

The method used in this research is work sampling. The data sampling methods consist: 1) Classification of workers activities in three activities. (Effective Work, Essential contributory work, ineffective work). 2) Data development by collecting field observation results in order. 3) Take a randomized observational data by involving workers in the field. 4)

Indicate the workers that classified into work effective activities, essential contributory work or ineffective work. 5) Record observations in the form, put a

checklist sign that worker's activities should be observed. 6) Add all checked worker for each activity and calculate the percentages.

**Table 1: Activities type group [8]**

Category	Activities		
	Formwork	Reinforcement	Concreting
Effective work (productive)	Direct activities	Direct activities	Direct activities: 1. Concrete compaction 2. Concrete seedling 3. Concrete testing
Essential contributory work (semi productive)	1. Plywood transportation in area 2. Scaffolding transportation 3. Scaffolding and plywood setting 4. Giving or receiving order 5. Crane operator 6. Shoring and bracing 7. Minor Cont. Work	1. Iron fabrication 2. Iron material transportation 3. Memberi atau menerima perintah 4. Giving or receiving order 5. Crane operator 6. Cleaning 7. Minor Cont. Work	1. Concrete transportation in area 2. Giving or receiving order 3. Crane operator 4. Concreting 5. Concrete flattening 6. <i>Concrete finishing</i> 7. <i>Curing the concrete</i>
Ineffective work (non productive)	1. Walking bare handed 2. Carry a material 3. Waiting for material or order 4. Waiting for the next job 5. Private time 6. Delay due to weather 7. Delay due to crane 8. Sitting, drinking, and smoking	1. Walking bare handed 2. Carry a material 3. Waiting for material or order 4. Waiting for the next job 5. Private time 6. <i>Delay</i> due to weather 7. Delay due to crane 1. Sitting, drinking, and smoking	1. Sitting 2. Looking 3. Smoking 4. Drinking 5. Waiting concrete to dry 6. <i>Delay</i> due to weather

After labor activity type's observation and recording completed, the calculation in each activity type can be done. Labour Utilization Rate (LUR) approachment was used to calculate labor productivity. LUR values were calculated with the following formula [9]:

$$LUR (\%) = \frac{\text{effective} + \frac{1}{4} \text{essential contributory}}{\text{total of observation}}$$

Effective and essential contributory is the number of workers who perform effective work and essential contributory work respectively and total of

observation is the total number of workers of three activity types (effective + essential contributory + ineffective work).

Number of observations during three months (July, August and September 2014) as many as 1771 that includes all kinds of activities in the work sampling on formwork, reinforcement, and concreting work. As shown in Table 2, proportion (%) is the percentage of one work sampling activity type compared with work sampling amount in one activity type.

**Table2: Work sampling analysis result**

Activities	Work sampling activities type		Number of observation	Proportion (%)	Total (%)	LUR (%)
Formwork	Effective	Direct activities	288	40.68	40.68	47.32
	Contributory	Transporting material and tools	188	26.55		
		Instruction	18	2.54		
		Ineffective	Walking barehanded	48	6.78	
	Doing nothing		128	18.08		
	Private time		38	5.37		
Formwork Total			708	100	100	
Reinforcement	Effective	Direct activities	308	35.94	35.94	43.17
	Contributory	Transporting material and	248	28.94	31.04	

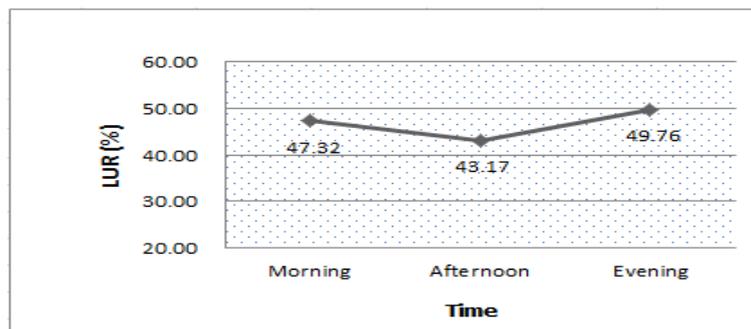
	Ineffective	tools			
		Instruksi	18	2.10	
		Walking barehanded	78	9.10	33.02
		Doing nothing	158	18.44	
		Private time	47	5.48	
Reinforcement Total	857	100	100		
Concreting	Effective	Direct activities	88	42.72	42.72
		Contributory	Transporting material and tools	58	28.16
	Instruction		8	3.88	
	Ineffective		Walking barehanded	8	3.88
		Doing nothing	38	18.45	
		Private time	6	2.91	
	Concreting Total	206	100	100	
Total of formwork, reinforcement, and concreting	Effective	Direct activities	684	38.62	38.62
		Contributory	Transporting material and tools	494	27.89
	Instruction		44	2.48	
	Ineffective		Walking barehanded	134	7.57
		Doing nothing	324	18.29	
		Private time	91	5.14	
	Sampling Total	1771	100	100	

**DATA ANALYSIS PROCEDURES**

**Work sampling**

After knowing all three activity types, the next observation's objects were structural work consisting of formwork, reinforcement and concreting work. The study was conducted according to the normal work hours starting at 08:00 AM until 17:00 PM. To perform observation on worker's normal activities, it was

recommended to not begin calculation for at least ½ hour after workers began to work in the morning or returning to work after the lunch break or ½ hour approached breaks or after work [7]. In this study, observation of normal hours was divided into three time periods in the morning (8:30 to 11:30), lunch (13:30 to 15:00), and afternoon (15:00 to 16:30) [9].



**Fig-1: LUR based on work hour**

**RESULTS AND DISCUSSION**

The research objects are the structural slab, columns and core wall, which include formwork, reinforcement and concreting starting from 25<sup>th</sup> level up to 39<sup>th</sup> level with a total of 15 levels. The proportion of each activity types in the three activity can be seen from Table 2 and Figure 2 which show the work sampling

total proportion of each activity for formwork, reinforcement, and concreting as a whole [3].

**Analysis based on work hour**

Analyzing LUR in the project based on the observation time (morning, afternoon and evening). Figure 1 shows the analysis of workers LUR value on the morning are lower than in the afternoon.

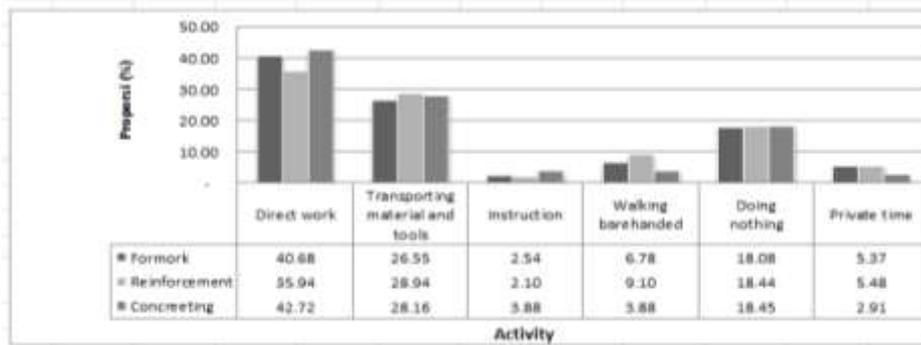


Fig-2: Activity types proportion at Menara Sentraya project

This was caused by workers experienced problem on the morning when transporting to work sites, while in the afternoon some workers did not work, so that the workers stamina was still good and the

weather was also conducive because it was not too hot compared to daytime. Figure 3 shows a comparison work sampling for formwork, reinforcement and concreting work.

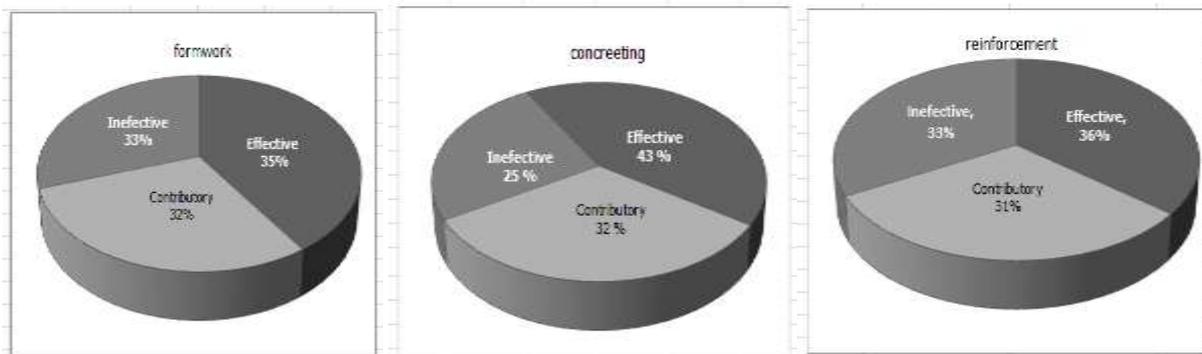


Fig-3: Comparison work sampling for each activities

Based on Table 2, the LUR value is 47.32% for formwork, 43.17% for reinforcement and 49.76% for concreting. Based the calculation, it can be seen that

the most productive work is the work with highest LUR value. Normal limit LUR value for construction project work is 40% - 60% [9].

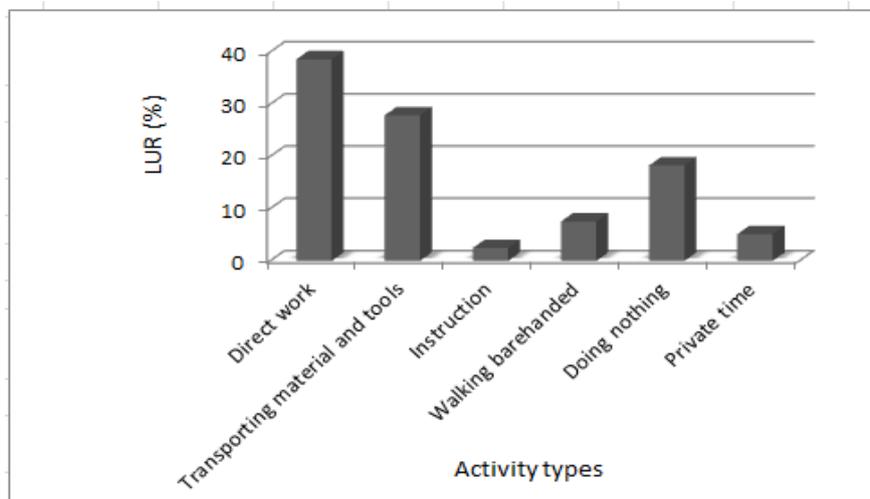


Fig-4: Structural work total proportion work sampling

**CONCLUSION**

Based on the analysis and discussion described above, it can be concluded that:

1. Formwork, reinforcement, and concreting total LUR value using work sampling method was 45.60%. It means that the project productivity was productive.

## SUGGESTION

1. Supervision to work quality needs to be improved more seriously to get better results.
2. Attention in similar projects need to concerned more about time in order to avoid delays in implementation.

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