PRODUCTIVITY ANALYSIS OF BUILDING GLASS CLEANING WORK USING ROPE ACCESS METHOD (CASE STUDY GLASS CLEANING OF SEMARANG STATE UNIVERSITY HOUSE OF SCIENCE BUILDING)

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Abstract. The need for buildings for various activities is increasing from time to time, the rapid construction of new buildings is generally not accompanied by an increase in maintenance and maintenance activities. Therefore, building maintenance is very important after the building is completed. To clean buildings, many methods are used to clean one of them is the rope access method, therefore in this analysis the researcher will look for the productivity of building cleaning using the rope access method, besides that researchers also have to observe how the procedures for installing safety equipment are used by workers. in the rope access method. To determine work productivity, researchers use the time study method to determine the time needed by workers to complete a job, then researchers will compare the value of worker productivity with the scaffolding method. After the researcher conducted the research, the researcher had data in the form of time which was then converted into m2/person/day. After that, researchers will find out how much the productivity ratio of each of these methods is. After recording the time value and converting it to m2/person/day, the result was found to be more productive using the rope access method because judging from the results of the researcher, it was found that the scaffolding work took longer because the higher the building, the longer the process of work and scaffolding installation. therefore,

Keywords: Productivity of Building Glass Cleaning Jobs Using the Rope Access Method.

1. Introduction

The need for buildings for various activities is increasing from time to time. The rapid construction of new buildings is generally not accompanied by an increase in maintenance and maintenance activities. Maintenance and maintenance of buildings is very important and necessary after the building is completed and used. Buildings on the Semarang State University UNNES campus require planned maintenance so that the smoothness and comfort of student activities in conducting lectures can be carried out properly. In

Indonesia there are still many buildings for education that are not well maintained, and in the end these buildings will be damaged. One of the factors causing damage to the building is the lack of maintenance and maintenance of the building. Including the building on the Semarang State University campus UNNES needs planned maintenance so that the smoothness and comfort of student activities in conducting lectures can be carried out properly. Maintaining the function and usability of the building as a whole with the efforts that must be made is to carry out maintenance and maintenance of the building properly and regularly so that the life of the building can be longer.

2. Method

A Research Design

This study uses a descriptive research design. Descriptive research method is statistics used to analyze data by describing or describing the data that has been collected as it is without intending to make general conclusions or generalizations.

B Labor productivity

Labor productivity is one measure of the company in achieving its goals. Human resources are the most strategic element in the organization, must be recognized and accepted by humans [1]

C Effective Work

Effective work according to the number of working hours that should be and work in accordance with the job description of each worker, will be able to support progress and encourage smooth business both individually and as a whole [2].

D Indicators of Work Productivity

According to Gilmore & Fromm in [3] indicators of work productivity are:

a. Constructive action. Take useful and positive actions that will support the realization of company goals.
b. Believe in yourself. Self-confidence that is owned by a person can improve the abilities they have so that they can improve their abilities so that they can increase work productivity.

E. Effective Employment Opportunity Policies

Effective employment opportunity policies are an important factor for increasing national productivity because national economic productivity must solely be viewed from the point of view of empowering all willing workers [2]

F Workforce Planning

Given that in general projects take place under different conditions, in planning the workforce it should be complemented by productivity analysis and indications of influencing variables [4].

G Time Study

Time Study is a work measurement technique by collecting data based on the time needed to complete a job. The Time Study method is used to calculate the standard time value of a job [5]

H Standard Time

Standard Time is the "should time" that is achieved by experts who work with standard ratings to complete a job [5]

I Research Locations

This research took place in cleaning the glass of a building in the Semarang State University Science House Library Building, located on Jalan Sekaran, Kec. Mount Pati, Semarang City, Central Java. In this study, observations were made about the level of work productivity in cleaning the glass outside of the building by means of rope access. The observation was carried out during working hours from 07.00-16.00, with breaks from 12.00-13.00. The implementation of this research was carried out for 1 month observing the work review.

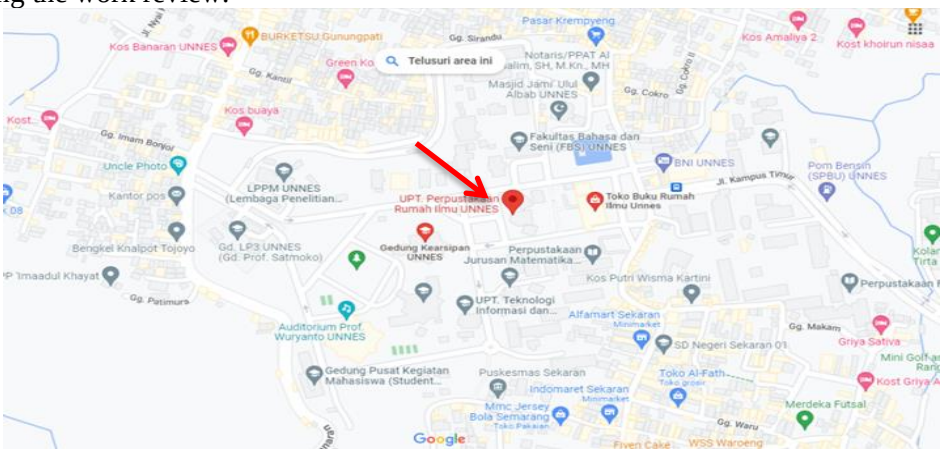

Figure 3.1Picture of the location plan of the UNNES Science House Library
Source: Google Maps, 2022

J Research Object

This research was carried out by collecting data from time measurements with a stopwatch for each work element in the work of installing safety devices for workers and the process of cleaning the outside glass of a building.

K Research Steps

The research steps are planned as follows:

1. Background: Describes the background of productivity analysis research.
2. Problem Formulation: Explaining the things that are the problem and the discussion in writing this final project.
3. Literature Study: Looking for existing theories to support the work of the final project.
4. Field Observations: Make observations of the work to be calculated work productivity. In this case, it is the process of installing safety devices on workers and the process of cleaning the outside glass of the building.

5. Data Collection: Collecting data in the field through direct observation. This observation takes field work as its object. Data collection is done by recording the duration of a job, the number of workers and the quantity of work.

L Contingency allowances

Contingency allowances are unexpected concessions and are intended to make standard time accurate. This happens due to factors that are not certain how long. Usually this happens because of damage to the equipment we want to use and things we don't want in the field, namely bad weather. Contingency allowances due to unforeseen events in construction projects are usually sufficient with a value of 5%. [6]

3. Results

The results of the comparison of building glass cleaning work using the rope access method are compared with the scaffolding method as follows.

table1 The results of the comparison of the rope access method and the scaffolding method

PROFESSION	Yield m2/day	Yield m2/person/day	Number of people
Rope Access Method	75,11	37,555	2 persons
Scaffolding Method	51.0605	25.5302	2 persons

From the results of the comparison of the cleaning work above, the value of the rope access work was 37.555 m2/person/day, while the scaffolding work was 25.5302 m2/person/day. So in one day the rope access work can clean 75.11 m2/day while using the scaffolding method 51.0807 m2/day, from the observations the rope access method is more effective because the movement of workers can be more flexible in reaching hard-to-reach areas such as buildings In the House of Science, it can be seen from the results of the comparison table above for work with the rope access method, there are more areas that can be cleaned.

Meanwhile, the scaffolding method is more effective when used to clean vertical glass buildings and is not difficult because the job of using scaffolding if you increase the height will also take longer in the installation process.

table2 Disadvantages and advantages of glass cleaning methods

No	Method	Advantages	Deficiency
a) .	Rope Access Rope Access	- fast in the installation of self-protection and safety ropes. -Can reach difficult vertical terrain.	-You have to make your own safety anchor above if the building doesn't have an anchor for the rope to work. -The level of comfort is less for workers because of the hanging working position.
b)	*scaffolding*	-Effective when using glass with a height of 9	-Not effective if used for cleaning with buildings whose terrain is

Method	Advantages	Deficiency
	meters and above there is no anchor for the access method rope. -Workers are more comfortable when working because the working position can stand.	difficult for workers to reach. -In the installation work, the higher the scaffolding, the longer the installation process will take.

From the comparison table of advantages and disadvantages above, we can conclude that each method has its own advantages, although there are still disadvantages to each process because the shape of the contours of the Science House building is different for each glass.

table3 Calculation of unit price analysis using the Rope Access method

Materials/Power	Needs	Unit price	Total price
Worker	2 OH	150,000	300,000
Matrial	Wipe, Soap	50,000	50,000
Safety Device	2 sets of rope access tools	200,000	400,000
	Total		750,000

Price calculation rope access method

Total price $=\frac{750.000}{75}$

= 10,000 /m2

so the value that must be spent in 1m2 for cleaning glass buildings is IDR 10,000/m2

Table 4.1Scaffolding method unit price analysis calculation

table4Scaffolding method unit price analysis calculation

Materials/Power	Needs	Unit price	Total price
Worker	2 OH	130,000	260,000
Matrial	Wipe, Soap	50,000	50,000
Rent Scaffolding	4Step	40,000	160,000
	Total		470,000

Calculation of the price of the scaffolding method

Total price $=\frac{470.000}{51}$

= 9.215 /m2

so the value that must be spent in 1m2 for cleaning building glass is IDR 9,215 m2

4. Conclusion

1. From the results of observations, the installation of safety devices must be carried out by workers who are competent in the field of rope access, therefore the installation of a full body harness along with the up and down devices must be installed based on their functions which have been explained in sub-chapter 2.6.1.
2. In this study the installation of basic anchorages uses non-permanent anchors so that the anchors used by workers to tether work ropes and safety ropes use webbing ropes that can be moored to the top of the building to be cleaned.
3. From the observations of researchers, maintenance of multi-storey buildings using the rope access method is faster compared to the scaffolding method, because if you use the rope access method, workers can reach parts that are difficult to reach, if you use the scaffolding method during the installation process, the higher the installation time, the longer it will take. workers need to clean it while the price per meter for the rope access method is IDR 10,000/m2 and for the scaffolding method IDR 9,215/m2.

5. Advice

1. Before carrying out the observation, it is better to carry out a simulation of recording the observe time first, so that during the observation there is no mistake in recording the observe time for each work activity.
2. Before constructing a building, you should also think about how the process of maintaining the building will be in the future, so that it will also make it easier for workers when they want to attach safety ropes, besides that we also take into account the anchors for safety ropes so that they can support a minimum load of around 15 KN based on Permenaker No. 9 of 2016 .
3. It would be better for a worker, especially work at the height of the rope access, for the worker to be equipped with training or certification of labor at height because with this training the worker will know the correct methods and regulations that have been determined, besides that it is also to anticipate negligence by workers who can be fatal for workers and those around them.

6. Bibliography

[1] Siagian, S, P. 2002. Tips to Increase Work Productivity. Jakarta: Rineka Cipta.
[2] Sinungan, Muchdarsyah. 2003. What Productivity and How. Jakarta: Earth Script.
[3] Sedarmayanti. 2004, Human Resources and Work Productivity. Bandung:
[4] Soeharto. 1995. Project Management from conceptual to operational. Jakarta: Erlangga Publisher.
[5] Pawiro, S. 2015 "Optimizing Labor Productivity in Construction Projects". Thesis.Manado: Civil Engineering, Faculty of Engineering, University of Sam Ratulangi.
[6] Trisiany, E, M., Halim, E. 2006. "Value Analysis of Labor Productivity Comparison Using Standard and Actual Methods (Case Study of Projects X and Y)". Thesis. Surabaya.