GROSTLOG 2023
Global Research on Sustainable Transport & Logistics

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

Analysis of the Performance of Loading Unloading PT Agung Raya

Edward Marpaung[a], Yolla Ayutia[b], Paulus Raga[c], Veronica[d], Aprilia Nurcantika Putri[e]

[a,b,c,d,e] Institut Transportasi dan Logistik Trisakti, Indonesia

Corresponding author: yollaayutia@lecturer.itltrisakti.ac.id

Abstract: A good job is one where completion time is short and accurate. To support the progress and get the results of loading and unloading performance measurement, it is necessary to use the right method of working time measurement and workload calculation to provide accurate information on the optimal time and workload size. PT Agung Raya is a private company engaged in logistics services. This kind of research is quantitative. This study directly measured work time, namely 3 containers of stripping activities and 3 containers of release cargo activities. The time-motion study method aims to determine the standard time of each work element, the amount of productivity and non-productivity, and the optimal workload for stripping and release cargo activities. The result of the standard time for stripping activities is 82 minutes with 74% productivity and release cargo activities require 52.3 minutes to complete with 88% productivity. The results of the workload analysis for the stripping and release cargo activities, which are owned by the workforce, exceed 100%, so there are suggestions for additional labour.

Keywords: *Stripping, Release Cargo, Time Motion, Productivity, Work load*

1. INTRODUCTION

International trade has a very rapid frequency and significantly affects the economy of a country, one of which is Indonesia. Transportation plays an important role in various fields, such as: economic, political, socio-cultural, environmental, defense and security. Because with the transportation of relations between one region with another will be smoother, save time and costs and bring great benefits to the community. Good transportation services can improve transportation services because it makes it easier for people to do business and meet their needs. International trade is essentially an activity of selling and buying goods consisting of exports and imports, most of which are carried out through sea transportation. There is a port that functions as a place for stockpiling imported or exported goods in the customs area or referred to as a warehouse for Temporary Landfill (TPS). To carry out goods handling activities in the warehouse, it is necessary to know the types of cargo and the properties of the cargo, the shape or size of each cargo with the aim of making it easier to handle or service on the ship or in the warehouse so that there is no damage to the cargo itself.

One of the most important resources for achieving good loading and unloading performance to run smoothly is a potential loading and unloading workforce. Without competent HR performance, the company will be difficult to run and operate properly, with the existence of a qualified potential workforce in a company can achieve the goals and targets that have been set. In a job, it will be said to be good if the completion time takes place briefly and precisely. The measure of success of the implementation of a work process is usually expressed in the form of productivity. Productivity cannot be measured if a company does not have a standard reference or standard time. So to get the best work size results, it takes a measurement of working time based on adjustment factors and relaxation factors from workers, and companies need to pay attention to the balance between the workload given to the workforce and the availability of existing labor. So that the company can provide satisfactory service to its customers. If the company is not able to meet the demand according to the specified amount and in a timely manner, it will cause disappointment for customers.

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

PT. Agung Raya is a private company engaged in logistics services, warehousing and management of temporary stockpiles in which there are loading and unloading activities located in the customs area of Tanjung Priok Port. In improving the quality of loading and unloading performance of a company must always be improved, this greatly determines the progress of a company. To support progress and obtain results of loading and unloading performance measures, it is necessary to carry out precise methods of measuring working time and calculating workload, so as to provide accurate information on the time and size of the workload needed and the efficiency of the movement of each activity to produce good performance.

In this study, direct measurement of working time was carried out using the time and motion study calculation method to determine the working time of each activity by taking into account the skills possessed by workers. The results of measurements with this method will be obtained standard or standard time to complete an element of work, where the time will be used as a standard for completing work. This measurement of working time will help determine the standard time of loading and unloading performance so that it helps the company determine how long the loading and unloading activity process is. Based on the description above, this study is intended to analyze various problems in the company including 1) the standard time of each element of work for stripping and release cargo activities, 2) the amount of productivity and non-productivity in stripping and release cargo activities, and the optimal percentage of workload for stripping and release cargo activities.

2. RESEARCH METHODS

According to (Zamrudi &; Nursanti, 2020) that the measurement of working time (Time and Motion Study) is an activity to determine the time needed by an operator who has above-average abilities and is well trained in carrying out a work activity in conditions and tempo.

Motion study is the movements carried out by the limbs of workers either using tools or not. According to (Monika Kussetya Ciptani, 2001) motion study consists of various aspects, namely description, systematic analysis and development of work methods in determining raw materials, processes, tools, workplaces and equipment for each activity itself. The purpose of this method is to determine the appropriate work method to complete an activity. Time study is a method to determine the length of time needed by a worker to complete a normal state with a set time measurement standard.

This study aims to determine the time needed to complete the elements of work that have been determined by considering several factors, namely by analyzing the factors of weakness, looseness. Thesteps carried out in this study are as follows: 1) literature study on time and motion study research, 2) observation and data collection of the process and time of the unloading activity process and environmental conditions that can affect the implementation of work, 3) determine the elements of work in the loading and unloading process, 4) m measure by using a stopwatch and record worker conditions, environmental conditions, 5) test data uniformity, test data adequacy, determine the rate of performance when carrying out measured work activities, allowance time, and determine standard work time and work time productivity, and calculatethe amount of productivity and non-productivity, 6) Calculate the amount of workload that is right for loading and unloading activities. Furthermore, it is known the number of proposed workers from the results of calculations, and conclusions are drawn regarding performance standards, the amount of workload and the number of proposed workers from loading and loading activities in the Company.

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

2.1 Time Motion Study Analysis

1) Data Uniformity Test

Data uniformity tests are carried out with the following calculation stages:

a. Divide data into subgroups:

$k = 1 + 3.3 \log N$ Note: $\bar{\bar{x}}$: Average value − average of subgroups

$\sum xi$: Average number of subgroups (seconds)

k : Number of subgroups

b. Calculate the average of a subgroup

$$\bar{\bar{x}} = \frac{\sum xi}{k}$$ Note: $\bar{\bar{x}}$: Nilai rata − rata subgrup

$\sum xi$: Average number of subgroups (seconds)

k : Number of subgroups

c. Calculate the actual standard deviation from the settlement time

$$\sigma = \sqrt{\frac{\sum(x_i - x)^2}{N - 1}}$$ Note: x_i : Nilai x ke − i

x : Average data value

N : Number of observations

d. Calculates the standard deviation from the mean distribution of subgroups

$$\sigma\bar{x} = \frac{\sigma}{\sqrt{n}}$$ Note: $\sigma\bar{x}$: Standar deviasi dari nilai rata − rata subgrup

σ : Standar deviasi waktu

N : Banyaknya dari setiap subgrup

e. Calculates the values of Upper Control Limit (BKA) and Lower Control Limit (BKB)

BKA = $\bar{\bar{x}} + 3\ \sigma\bar{x}$

BKB = $\bar{\bar{x}} - 3\ \sigma\bar{x}$

2) Data Sufficiency Test

$$N' = \left(\frac{\frac{k}{s}\sqrt{N.\sum x_i^2 - (\sum x_i)^2}}{\sum x_i} \right)^2$$ Note: N′ : Number of observations made

N : Number of observations to be made

x_i : i-th measurement data

k : Level of confidence

s : Level of accuracy

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

3) Determining Standard Time

a. Cycle time, is the time between the average completion of observations.

$$Ws = \frac{\sum xi}{N_i}$$ Note: X : Number of cycle times
N : Amount of data

b. Normal Time, time obtained from observation by providing a separate assessment of worker performance.

c.

$$W_n = W_s \times p$$ Note: Ws : Average Cycle Time
p : Adjustment Factor (Performace Rating)

d. Standard Time, Standard time, also called standard time, is a calculation that requires the value of the allowance factor (Allowance Time).

$$Wb = \sum Wn \times \frac{100}{100 - \text{allowance (\%)}}$$ Note: W_n : Normal Time

2.2 Calculation of Productivity and Non Productivity

Based on (Sritomo Wignjosoebroto, 2006) the calculation of productivity can be known using the following formula:

$$\%\text{Produktivitas} = \frac{\text{Jumlah kegiatan produktivitas}}{\text{Jumlah pengamatan}} \times 100\%$$

Here's for non-productivity calculations:

$$\%\text{Non Produktivitas} = \frac{\text{Jumlah kegiatan non produktivitas}}{\text{Jumlah pengamatan}} \times 100\%$$

2.3 Workload Analysis

Workload based (Putra et al., 2020) is a measure and working weight of the limited worker capacity needed to perform a particular worker. Based on (Arif, 2012) for workload calculation using the formula, as follows:

$$\text{Beban Kerja} = (\%\text{Produktivitas x Performance Rating}) \text{ x } (1 + \text{Allowance Time})$$

3. RESULTS AND DISCUSSION

3.1 TIME MOTION ANALYSIS

a. Stripping Activities'

The results of the calculation of the total performance rating, in the element of work 1, namely taking photos of cargo in containers showed an overall value of 1.25, the element of work 2, namely cargo carried by forklifts to the putaway area showed an overall value of 1.23 and the element of work 3, namely moving cargo to the warehouse rack showed a value of 1.2 from the average of three observations as subjects of observation. Based on

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

the table above, the average allowance time from three observations was obtained for Fatique Allowance of 40%. Personal Allowance factor is 5.6% and Delay Allowance factor is 5%, so the total average Allowance Time is 50.6%. From the calculation above, we can obtain the standard time or standard time of container stripping activities, for work to take photos of cargo conditions in containers takes about 45 seconds in one cargo photo taking. Cargo work carried by forklift to putaway area takes about 172 seconds in one cargo pickup and the work of moving cargo to warehouse rack takes about 196 seconds in one cargo pickup. So that the total standard time or standard time for stripping activities is around 82 minutes. In more detail the elements and timing of stripping work are presented presented in the following table 3.1:

Table 3.1 Elements and process time of cargo stripping

Work Elements	Performance Rating	Allowance Time	Standard Time
Work Element 1 (Taking photos of the condition of the cargo in the container)	1,25	50,60%	45 detik
Work Element 2 (Cargo carried by forklift to putaway area)	1,23	50,60%	172 detik
Work Element 3 (Moving cargo to warehouse racks according to type and capacity)	1,21	50,60%	196 detik

The calculation of Performace Rating can be done by adding the factors that affect the speed of a person doing work and plus a value of 1. Performance Rating considers 4 influencing factors, namely Skill, Effort, Condition, Consistency. In performance rating, if the workforce is declared too fast so that it works above the normal limit, this factor rating will be greater than 1. So based on the results of observations and calculations on performance rating, stripping activities are above average because the rating factor is more than 1.

b. Release Cargo Activities

The results of the calculation of the total performance rating, in job element 1, namely Cargo brought from racking out to putaway showed an overall value of 1.25, in work element 2, namely cargo loaded into the container showed an overall value of 1.24 and work element 3, namely the photo of cargo in the container showed a value of 1.24 from the average of three observations as the subject of observation. Based on the table above, the average allowance time from three observations of release cargo is 40.6%.

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

Personal Allowance factor is 4.3% and Delay Allowance factor is 5%, so the total average Allowance Time is 50%.

From the calculation above, the standard time or standard time of container release cargo activities is obtained, for cargo work brought from racking out to putaway takes about 136 seconds in one cargo pickup by forklift. Cargo work loaded into the container takes about 148 seconds in one cargo pickup and cmeter photo work in the container about 30 seconds in one cargo photo taking. So that the total standard time for container release cargo activities is around 3,140 seconds or 52.3 minutes. In more detail the elements and time of release cargo work can be seen in table 3.2 below:

Table 3.2 Elements and timing of release cargo

Work Elements	Performance Rating	Allowance Time	Standard Time
Work Element 1 (Cargo carried from racking out to putaway)	1,25	50%	136 detik
Work Element 2 (Cargo loaded into container)	1,24	50%	148 detik
Work Element 3 (Photo of cargo in Container)	1,24	50%	30 detik

The calculation of Performace Rating can be done by adding the factors that affect the speed of a person doing work and plus a value of 1. Performance Rating considers 4 influencing factors, namely Skill, Effort, Condition, Consistency. In performance rating, if the workforce is declared too fast so that it works above the normal limit, this factor rating will be greater than 1. So based on the results of observations and calculations on performance rating, release cargo activities are above average because the rating factor is more than 1.

3.2 Productivitiy Analysis

The taking of this research was carried out 3 working days starting from working hours, namely 08.00 – 17.00 WIB and productive and non-productive activities can be known by taking data as many as 49 observation data for stripping and release cargo activities, shown in table 3.3 below:

Table 3.3 Productivity and Non Productivity Time in Stripping and Release Cargo Activities

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

Day	Container Stripping Activity		Total Observations	Cargo Container Release Activity		Total Observations
	Productive	Non-Productive		Productive	Non-Productive	
1	36	7	49 Data	43	6	49 Data
2	35	11	49 Data	45	4	49 Data
3	38	5	49 Data	41	8	49 Data

a. Container Stripping Activities

First day : $\%\text{Produktivitas} = \frac{36}{49} \times 100\%$

$\%\text{Produktivitas} = 73\%$

Second Day: $\%\text{Produktivitas} = \frac{35}{49} \times 100\%$

$\%\text{Produktivitas} = 71\%$

Third Day: $\%\text{Produktivitas} = \frac{38}{49} \times 100\%$

$\%\text{Produktivitas} = 78\%$

$$\text{Total average productivity} = \frac{73\% + 71\% + 78\%}{3}$$

$$= 74\%$$

Based on the results of observations made by researchers for 3 days, it was obtained with a total of 147 observations, so that the average productivity in stripping activities was 74%.

b. Container Release Cargo Activities

First day: $\%\text{Produktivitas} = \frac{43}{49} \times 100\%$

$\%\text{Produktivitas} = 88\%$

Second Day: $\%\text{Produktivitas} = \frac{45}{49} \times 100\%$

$\%\text{Produktivitas} = 92\%$

Third Day: $\%\text{Produktivitas} = \frac{41}{49} \times 100\%$

$\%\text{Produktivitas} = 84\%$

$$\text{Total average productivity} = \frac{88\% + 92\% + 84\%}{3}$$

$$= 88\%$$

Based on the results of observations made by researchers for 3 days, it was obtained with a total number of 147 observations, so that the average productivity in release cargo activities was 88%.

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

3.3 WORKLOAD ANALYSIS

a. Stripping Activities

The actual workload of stripping activities of job element 1 is 139%, job element 2 is 137% which means, stripping activities have a high load that requires additional labor. The following workload calculation, can be known as follows:

Actual Workload = (%Produktivitas x Performance Rating) x (1 + Allowance)

The following to see the proposed workload and the optimal number of workers in each work on 1 container can be seen in table 4.4 below:

Table 3.4 Workload of Cargo Stripping Activities

Work Elements	Total Actual Employment	Actual Workload	Proposed Workforce	Proposed Workload	Note
Work Element 1 (Taking photos of the condition of the cargo in the container)	1 person	139%	1 Person	69,50%	The workforce's workload exceeds 100%, so there are workforce proposals
Work Element 2 (Cargo carried by forklift to putaway area)	1 person	137%	1 Person	68,50%	The workforce's workload exceeds 100%, so there are workforce proposals
Work Element 3 (Moving cargo to warehouse racks according to type and capacity)	2 person	67%	-	-	The workforce's workload is <100%, so there are no workforce proposals

In job element 1, job element 2 and job element 3 it can be seen that each workload owned by the workforce exceeds 100%. According to (Farhana, 2020) A good workload, preferably close to 100% or under normal conditions. So that the proposal to add labor to work element 1 (Taking photos of cargo conditions in containers) requires additional labor, namely 1 person so that the proposed workload is 69.5%. In work element 2 (Cargo carried by forklift to putaway area) need an additional 1 workforce with a proposed workload of 68.5. And for work element 3 (Moving cargo to the warehouse rack according to its type and capacity) there is no need to add more labor, because the actual workload is already 67%.

b. Release Cargo Activities

The actual workload of stripping work element 2 is 165%, and job element 3 is 163%, which means, release cargo activities of each work element have a high load so that it requires additional labor. The following workload calculation, can be known as follows:

Actual Workload = (%Produktivitas x Performance Rating) x (1 + Allowance)

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

So that the calculation results can be known, theoptimal workforce in each work of 1 container is as follows:

Table 3.5 Release Cargo Workload

Work Elements	Total Actual Employment	Actual Workload	Proposed Workforce	Proposed Workload	Note
Work Element 1 (Cargo brought from racking out to putaway area)	1 person	139%	1 Person	69,50%	The workforce's workload exceeds 100%, so there are workforce proposals
Work Element 2 (Cargo loaded into container)	1 person	137%	1 Person	68,50%	The workforce's workload exceeds 100%, so there are workforce proposals
Work Element 3 (Photo of cargo in container)	2 person	67%	-	-	The workforce's workload is <100%, so there are no workforce proposals

Based on the calculation above, work element 2 and work element 3 obtained an actual workload of 163%, so there should be an increase in labor for each element. in element 2 (Cargo loaded into container) requires an additional 2 labor, and work element 3 (Photo cargo in container) requires an additional 1 workforce with each proposed workload of 81.5%. Job element 1 does not need additional manpower because the actual workload is 82.5%.

4. CONCLUSION AND ADVICE

a. Conclusion

1. In the work measurement process, the company PT Agung Raya provides a regulation for rest hours, which is 60 minutes at 12.00 WIB – 13.00 WIB of the total time of workers. However, in the study, the author found a discrepancy in theories and phenomena that occur in companies, namely that there are some workers using rest time and personal time outside of rest hours, this happens because of lack of supervision to workers.
2. Based on the calculation of standard time or standard time using the time and motion method with objective adjustment factors and cladding factors, the total standard time is obtained:
   - In stripping activities, Work Element 1 (Taking photos of cargo conditions in containers) takes about 45 seconds in one cargo photo taking. Work Element 2 (Cargo carried by forklift to putaway area) takes about 172 seconds in one cargo pickup and Work Element 3 (Moving cargo to warehouse rack) takes about 196 seconds in one cargo pickup. So that the total standard time or standard time for stripping activities is around 82 minutes.
   - In cargo release activities, for Work Element 1 (Cargo is brought from racking out to putaway) it takes about 136 seconds in one cargo pickup by forklift. Job 2 (Cargo loaded into container) takes about 148 seconds for one cargo pickup and job element 3 (Photo cmeter in container) about 30 seconds in one cargo photo pickup. So that the total standard time for container release cargo activities is around 3,140 seconds or 52.3 minutes.

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

3. The calculation results show that the productivity level of container stripping activities reaches 74% and for container release cargo activities, work productivity reaches 88%, which means that the productivity of loading and unloading activities can be said to be good and sufficient. And the calculation results show that the level of non-productivity of container stripping activities reaches 26% and for container release cargo activities, work productivity reaches 12%.
4. Based on the results of the workload analysis of stripping and release cargo activities owned by the workforce exceeding 100% so that there is a proposal for additional work, namely in stripping activities for Work Element 1 it is necessary to add 1 workforce with a proposed workload of 69.5%, in Work Element 2 there is an addition of 1 workforce with a proposed workload of 68.5%. In the release cargo activity, work element 2 and work element 3 require an additional 1 workforce with a proposed workload of 81.5%.

b. Suggestion

1. Themeasurement of working time based on adjustment factors and allowance factors can be applied to measure the company's standard time.

2. Loading and unloading activities need tighter supervision so that workers do not carry out ineffective activities, such as chatting excessively and playing mobile phones.

3. In determining the workload and number of workers in loading and unloading activities, PT Agung Raya should apply the time motion study method so that the use of labor can be more efficient.

REFERENCE

Arif, R. (2012). Analysis of the optimal workload and number of workers in the production department with the Work Load Analysis method approach at PT Surabaya Perdana Rotopack.

Farhana, D. H. (2020). Workload analysis in determining the optimal number of workers with the workload analysis method at PT Jaya Teknik Indonesia. Scientifict Journal of Indsutrial Engineering, 1(2).

Monika Kussetya Ciptani. (2001). Increased productivity and cost efficiency through the integration of time & motion study and activity-based costing. Journal of Accounting and Finance, 3(1). http://puslit2.petra.ac.id/ejournal/index.php/aku/article/view/15679

Putra, S., Handoko, F., &; Haryanto, S. (2020). Workload Analysis Using Workload Analysis Method in Determining the Optimal Number of Workforce in CV. Jaya Perkasa Teknik, Pasuruan City. Valtech Journal (Journal of Industrial Engineering Students), 3(2), 82–85.

Sritomo Wignjosoebroto. (2006). Ergonomics of Motion and Time Studies: Analytical Techniques for Increased Work Productivity (4th ed.).

Zamrudi, I., &; Nursanti, E. (2020). Improvement of working methods through time and motion studies to increase aluminum foil production capacity. 3(1), 46–51.