

# The Physical Workload Analysis By Cardiovascular Load (CLV) Method For Administration Employees

Shinta Prastika, Dayal Gustopo, Prima Vitasari

**Abstract:** A workload adjustment is an important factor in any type of work. Adjustment of physical workload must be maintained in balance to make employees not burnt out by excessive workload when carrying out their activities. Excessive workload can lead to decreased work productivity, work motivation, work injuries, and reduced concentration. This service company is one of the state companies run in shipping and logistics services businesses. It must be able to control the workload to make it appropriate for its employees. The service company owns many subsidiaries throughout Indonesia, although difficult to evaluate, this company must be able to balance the physical workload in its entire company. One example from the branch of Malang Raya showed an unbalanced physical workload. Therefore it is necessary to measure the workload in this study by applying the Cardiovascular Load (CVL) Method. This method is used by several previous studies to measure the physical workloads. The measurement instrument to gauge the physical workload is an oximeter. Participants in this study were the employees with a total amount of 30 people. It conveys an average result of 40.75 % from 30 employees taken of the branch of Malang Raya. This result measurement categorized as high classification of workload so that improvements are needed to help in balancing the physical workload which experienced by most of its employees. From the workload measurement, this service company should consider the evenly distributed tasks or workloads over each employee in this company, especially for those who have experienced physical overload. In addition, it is necessary to consider additional employees at branches of service companies whose working conditions had reached the workload limit. As for the next researcher, it can be analyzed to see the mental workload and employee needs for each branch of this service company.

**Index Terms:** workload, cardiovascular load, heart rate, ergonomics, productivity

## 1 INTRODUCTION

In general, some service companies are currently battling with changes in the business environment whether internally and externally as a result of technological developments and the global economy. Therefore, logistics service companies must remain able to compete with new competitors such as emerging shipping and logistics services like JNE, J&T, JET Express, Wahana, Tiki, and others. To retain its competitive edge, this service company also improving the service quality by creating several types of new product services like express mail, postal cargo, and Q-comm as their most current product. The development of these new products would be better supported by the availability of sufficient human resources, which unfortunately several problems such as not adequate staff in their service lining became a poor assessment for logistics service companies. Several problems often occur in service companies which related to the unbalanced workload of employees such as: 1) the N2 report at closing time often having miscalculation/different financial amount from its cashier counter, 2) a large number of consumers every day with various types of postal products that employees must served and variety of data entry applications that employees also must do, 3) the main postal product related to pentenary fund is unable to be performed well (especially on the 1st to 15th at the beginning of the month), 4) when queues are full, factor of service speed often becomes a priority than accuracy, as a result some data entry are inaccurate. On the basis of these problems, one approach is selected to determine the physical workload experienced by the branch office employees by applying the Cardiovascular Load (CVL) method. According

to (A. Luque-Casado et al, 2016) states that the Cardiovascular Load method through the heart rate is able to observe heart rate or pulse variations as a cognitive function and balance the workload physically. Therefore, this study aims to determine the physical workload experienced by employees at delivery service companies in Malang Raya area and to analyze employees' physical workload using the CVL method.

## 2 LITERATURE REVIEW

### 2.1 Workload

The definition of workload according to (R.L. Charles, 2019) is an important variable used to measure an employee's performance in his or her activities. Each employee obviously has a different workload for each work performance in the form of physical workload, mental workload, as well as social workload. It influenced by the type of activity carried out by each employee. Castro, Strayer, Matzke, and Heathcote (2019) also stated that the workload received by everyone can also endanger their own lives and others every day when the workload received is not balanced, even more when the workload is done by splitting their focus to some tasks, for example, while driving and having conversation through cellphone at the same time. From Thammarak and Witthaya (2020), workload can be defined as the type of work that performed by employees which include job duties, responsibilities, and anything in work space coverage and usually each employee also has their own responsibility of their respective workload. According to Thammarak and Witthaya (2020) workloads can be divided into three types, namely task-level workload, unit-level workload, and work-level workload. Thammarak and Witthaya (2020) also found that work overload will occur when employees receive workloads that are beyond their abilities caused by increased productivity and high demand for performance. Increased productivity found to occur on a large scale in employees who

- *Shinta Prastika is currently pursuing masters degree program in industrial engineering in ITN, Indonesia, PH-+61281232236009. E-mail: shintaprastika90@gmail.com*

participate in an organization where usually certain job completion is must be done during predetermined time. Then it can be concluded that excessive deadlines and workloads will make employees often experience high levels of stress. Y. Gan et al (2020) said that workload can be described as a relationship between the number of task requests being performed by a resource and the ability of task implementer to supply the resources. Hence, there are three things that are used for an analytical assessment of workload namely: sensory, cognitive, and psychomotor aspects. Y. Gan et al (2020), also stated that as a product of task complexity, the workload will usually increase due to the increasing complexity of the task, and as a response, employees will experience a high level of stress. It is also supported by Thammarak and Witthaya (2020), showing that workload will cause fatigue and errors at work in which can lead to emotional exhaustion. Aside from that, the workload can create opinion impact of different generations. As we know that in an organization, data of employees consist of various ages or generations and characters. Opinions from each generation will be different, where some generations might be say that a heavier workload will affect the work quality while others stated that a heavy workload will not affect the quality of work. Furthermore, Ilies et al. (2015) found that within a job where an employee felt overloaded with work, this will bring conflict to the family. This type of problem mostly occurs in employees who receive heavy workload and they can not cope or balancing their work with their family responsibilities. This is also supported by by Molino, Cortese, Bakker, and Ghislieri (2015) by stating that they found a strong relationship between workload and family conflict.

## 2.2 Physical Workload

Physical workload according to (Y. Gan et al, 2020) is a workload that able to assess by measuring the heart rate. The variables of heart rate and heart respiration can be a good indicator to assess physical workload. The physical capacity from a person will affect his or her behavior in carrying out every activity. A high physical workload combined with complex work conditions (such as in noisy condition of work system, working time, work facilities, and work environment), will increase the likelihood of errors in his/her activities, so workload evaluation is an important research to get effective and efficient activities at work. C. St-Onge, N. Kara, O.A. Wahab et al (2020) also stated that measuring workload can be taken as an approach in decision making. A decision making is necessary to optimize any strategy taken for providing resources and to anticipate any workperformance problems that occur. Andersen (2016) also stated that a high physical workload can lead to poor body health. Examples of ordinary physical workloads are bending or turning your back, working with your arms over your shoulders, squatting or kneeling, as well as pushing, pulling, lifting or carrying objects. There is a statement saying that physical workload will have an impact on physical health problems that also been proven by Yu Yantao (2018), physical workload is proven to be one of the main risk factors for major injury and even more musculoskeletal disorders. To provide an assessment of the physical workload, this workload will be measured from two different loads: the biomechanical load and the cardiovascular load.

## 2.3 Methods of Measuring Workload

The usual procedures to measure the physical workload can be taken from utilizing cardiac, respiratory, eye, speech, and brain activities. Variables of heart rate activity or pulse rate activity are the common method for measuring workload (M. Shakouri et.al, 2018). Previous research conducted by Kamilla Run Johannsdottir (2017) stated that measuring physical workload with the cardiovascular load method can also monitor and manage physical workload, so it is used as a way to maximize human performance, minimize errors, and ensure physical and mental health of employees in the best possible way. The action taken to measure the physical workload carried out by Kamilla (2017) by using blood pressure regulation which was also aimed for detecting workload onset and offset but not consistently differentiating between individual task load levels. The cardiovascular load method with Electrodiagram as a support device can also be used to measure physical workload (A. Stuver et al., 2014). The direction in using this device is placing it on the two lowest ribs and in between the left and right chest. In addition, it also can be used to measure blood pressure. The results that can be obtained are heart rate and blood pressure measurements. These variables play as indicators of changes in improvement plan in setting workloads for a long period of time. According to (Darvishi, 2016), a high physical workload will also cause physical fatigue, stress, and irritability which in a way will take effect on lowering the level of concentration, decreasing productivity at work of employees and even causing losses to the company.

## 3 RESEARCH METHODOLOGY

### 3.1 Participants

Respondents involved in this study consisted of 30 employees of service company branch office. The number of male respondents is 25 employees, and the number of female employees is 5 employees. The average age of the respondents was 35 to 44 years, with a percentage of 66% of them are on working period between 2 and 6 years.

### 3.2 Physical Workload Measurement

In this study, the measurement of the pulse during before and after work is a method for assessing cardiovascular strains. The equipment for this study is an oximeter. Elevating pulse has a very important role in increasing cardiac output from rest to optimal work. An approach for taking a physical workload measurement is the Cardiovascular Load (CVL) method. The steps are as follow:

1. Conducting physical workload measurement through heart rate variable.
2. Pulse measurement is carried out while doing work.
3. Work rate calculation used to assess the weight (heavy or light) of a workload.
4. By using this method, pulse rate can be calculated as:
 
$$\%CVL = \frac{100 \times (\text{working pulse} - \text{resting pulse})}{\text{max pulse} - \text{resting pulse}} \quad (1)$$

There is another study done by cardiovascular load came from Rieska E. (2019), stated that this method helps to find out the physical workload by measuring the pulse based on energy release. Method of calculating pulse rate is obtained by 10 pulse method using a stopwatch. It obtains results that state a

high physical workload in a management system will affect an activity, so that it will affect in the declining of employee's work quality.

#### 4 RESULT

The next data that will be presented here is a recapitulation of physical workload observation obtained from employees at Malang Raya branch office which taken by oximeter device. The data obtained are as follow:

**Table 1**

**Employees Pulse Rate Recapitulation Data**

No.	Employee's id	Gender	Age	Heart rate		
				Rest time	Work time	HR Max.
1	A	P	32	60	75	100
2	AC	L	34	60	70	100
3	AS	L	33	62	68	75
4	AT	P	40	60	70	85
5	AD	L	44	65	80	110
6	AN	L	46	62	90	120
7	SW	L	37	61	70	90
8	Y	P	37	62	75	105
9	D	P	37	65	75	90
10	EP	L	46	61	85	110
11	L	P	38	62	75	100
12	MD	L	36	61	70	100
13	AG	L	47	60	90	120
14	B	L	40	63	85	110
15	AJ	L	44	60	83	105
16	LS	L	50	63	79	115
17	DW	L	54	65	88	105
18	G	L	49	60	70	90
19	AA	L	40	65	82	105
20	AY	L	38	62	85	110
21	YB	L	37	60	75	95
22	CH	L	39	66	80	95
23	DP	L	36	62	75	100
24	AB	L	38	60	82	105
25	F	L	42	62	80	110
26	MF	L	40	60	85	120
27	ADW	L	37	61	80	95
28	P	L	37	62	90	120
29	RY	L	40	65	78	100
30	T	L	41	62	78	115
Average			40	62	79	103

From data recapitulation in table 1, the pulse rate measurement states that calculation from employees with average age of 40 years old from Malang Raya branch office area are 62 pulse rate in resting condition, 79 pulse rate in working condition and 103 pulse rate in maximum condition. After collecting pulse rate measurement recapitulation data from each employee, the next step is classifying physical workload by Cardiovascular Load (CVL) method. Rieska (2017) states that the classification is as follows:

<30% = No fatigue

30 - <60% = Required repairs

60 - <80% = Work in no time

80 - <100% = Immediate action required

> 100% = Not allowed to move

After obtaining the calculation results for the pulse rate experienced by employees at the branch office, the next step is to classify each physical workload experienced by service company office employees at the branch. The results of the classification in table 2 are as follows:

**Table 2**

**The CVL Calculation of Employee's Physical Workload**

No.	Employee's id	Age	Result	Workload Category
1	A	32	37,50	Required repairs
2	AC	34	25,00	No fatigue
3	AS	33	46,15	Required repairs
4	AT	40	40,00	Required repairs
5	AD	44	33,33	Required repairs
6	AN	46	48,28	Required repairs
7	SW	37	31,03	Required repairs
8	Y	37	30,23	Required repairs
9	D	37	40,00	Required repairs
10	EP	46	48,98	Required repairs
11	L	38	34,21	Required repairs
12	MD	36	23,08	No fatigue
13	AG	47	50,00	Required repairs
14	B	40	46,81	Required repairs
15	AJ	44	51,11	Required repairs
16	LS	50	30,77	Required repairs
17	DW	54	57,50	Required repairs
18	G	49	33,33	Required repairs
19	AA	40	42,50	Required repairs
20	AY	38	47,92	Required repairs
21	YB	37	42,86	Required repairs
22	CH	39	48,28	Required repairs
23	DP	36	34,21	Required repairs
24	AB	38	48,89	Required repairs
25	F	42	37,50	Required repairs
26	MF	40	41,67	Required repairs
27	ADW	37	55,88	Required repairs
28	P	37	48,28	Required repairs
29	RY	40	37,14	Required repairs
30	T	41	30,19	Required repairs
Average		40	40,75	Required repairs

From table 2 description above showed that two employees of the branch office of the service company did not experience physical fatigue at working condition while the rest of 28 employees had an average CVL value of 40.75. By these

average results suggest that needs repair to the physical workload of employees at Malang Raya branch office.

#### 4 ANALYSIS

The analysis of physical load from the calculation result explained above showed that smallest workload value is MD employee with a cardiovascular load percentage of 23.08%. This small percentage due to employee's resting pulse is more than adequate when compared to the pulse in working condition or after finishing work and this can also be influenced by many factors including age and health record from the employee. Furthermore, by calculating the workload, it is also known that there is a branch office employee who has a high CVL percentage value namely DW employee with a value of 57.50 %. This high CVL percentage value is due to the fact of so many jobs serving customers even accompanied by carrying or shipments or parcels during service causing the employee get tired easily, also supported by the working atmosphere in this office has a hot climate that impacted on the employee, as well as the age and endurance factors of the employee. From result measurement, these calculation can be classified according to (Rieska E., 2017) where gives a conclusion that employees of Malang Raya branch office were experiencing physical fatigue at work and the need for improvement to support employee's productivity at work.

#### 5 CONCLUSION

The result of physical workload calculation by applying the Cardiovascular Load (CVL) method showing that employees from Malang Raya branch office are included in the high physical workload category because the administrative staff in this branch office also perform work in moving goods in their process activities other than administrative working activities. The physical workload of service company branch office employees that classified into quite high category will affect the declining quality and productivity of their work so it is necessary to evaluate improvements in a balanced system of distribution of workloads for each service company branch office employee to get a balance of workload. In further research, it can be analyzed in detail about the effect of mental and physical workloads and labor requirements for each branch office of this service company.

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