Influence of Physical Work Environment: Temperature, Humidity, Light Intensity, and Vibration on Construction Worker's Subjective Comfort

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Abstract. The physical work environment is everything around workers that can affect them in carrying out work tasks, such as lighting conditions, temperature, humidity, and vibrations caused by the use of specific tools. This study aims to evaluate the physical factors of the work environment and quantify the influence of these factors on the personal comfort level of project workers. The factors of light intensity, temperature, humidity, and vibration were measured using a lux meter, hygro-thermometer psychrometer, and vibration meter. The measurements were conducted during the 6 (six) working days at a building construction site in Jakarta. Subjective comfort was surveyed using questionnaires filled out by the workers. During the study, the workers were active in 5 (five) different workstations, including pipework, installation of cable networks, ducting assembly, and welding. Measurement in all stations resulted in an average light intensity of 196.6 lux, a temperature of 30.97°C, a humidity of 55.29%, and vibration of 9.4 m/s which sometimes violates the national threshold value regulated by the Minister of Labor of the Republic of Indonesia Number 5 of 2018. A multiple linear regression analysis was carried out to quantify the influence of the parameters on the workers' subjective comfort using the SPSS Software Version 25.0. The multiple linear regression analysis showed that for a 95% confidence level, all parameters together have a statistically significant influence on the subjective comfort of workers with Sig = 0.001. While only temperature (Sig = 0.019) and vibration (Sig = 0.001) have an independent statistically significant influence, temperature and vibration become priority parameters for workers' subjective comfort improvement. The comfort of the working environment on temperature and vibration parameters can be improved by providing a portable fan and making a rubber engine holder for dampening vibrations.

Keywords: Light intensity, Temperature, Humidity, Vibration, Subjective comfort, Construction, PPE

1 Introduction

Occupational Safety and Health (OSH) in every company is essential to pay attention to. The improvement and development of OSH in the development construction sector are carried out to minimize the risks and hazards arising from work. OSH protects workers from being safe and healthy without experiencing health problems (Prayoga, 2014). Workers are human resources

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that are very important in contributing to the company's goals. If human resources have good quality and performance, it is the most valuable asset for every company (Sutrisno, 2016).

The role of humans as workers will realize good work effectiveness for a company. Therefore, to foster the effectiveness of workers at work, several aspects must be considered by the company, one of which is the aspect of the physical work environment. The physical work environment is everything around the worker that can affect him in carrying out the duties of a job, such as lighting conditions, temperature, humidity, and vibrations caused by the use of specific tools (Wignjosoebroto, 1995). Work environment conditions significantly affect a person's comfort and performance directly or indirectly (Manuaba, 2000). The condition of the physical work environment at the work site contains many hazards that can adversely affect occupational safety and health (Sucipto, 2014). A low level of management of the quality of the physical work environment will automatically reduce work productivity. Problems that often occur due to lack of attention to the conditions of the physical work environment, especially light intensity, temperature, humidity, and vibration, namely resulting in workers experiencing eye fatigue, headaches, heat stroke, heat cramps, hearing loss, eye damage, disorders of the nerves in the body, and Hand Arm Vibration Syndrome (HAVS) (Kristanti, 2017). Based on brief discussions with workers, workers claim to experience complaints about physical factors of the work environment that make them uncomfortable in carrying out their work.

Based on discussions with the HSE officer at PT X and referring to the Minister of Manpower Regulation No. 5 of 2018 in article 60, it is stated that companies are required to conduct environmental tests at least two times in 1 year to determine the condition of the work environment in development projects. Therefore, the parameters to be measured will adjust to the conditions and work being carried out in the development project.

2 Research Methodology

This study will measure physical factors in the work environment with selected parameters of light intensity, temperature, humidity, and vibration using a Luxmeter, Hygro-Thermometer, Psychrometer, and Vibration meter. The location of the workstation used for research is a work area that has a medium level of accuracy, such as pipe welding, electrical installation assembly, and jobs that use tools or machines that have the potential to cause vibration. After taking measurements at each workstation, the results of the measurements will be analyzed and compared with the standard threshold values set by the government in the Minister of Manpower Regulation No. 5 of 2018 concerning occupational safety and health, Minister of Health Regulation No. 1405 concerning occupational, environmental health, SNI 05-2298-1991 and in SNI 16-7063-2004 to find out whether the results of the measurements at each location are following the quality standard values.

After obtaining and analyzing the measurement results, the next stage is to determine the relationship or influence of the physical factors of the work environment that have been measured in the construction project on worker comfort. The relationship analysis will be carried out using a questionnaire which will then be processed using the multiple linear regression method.

2.1 Light Intensity Measurement

Measurement of light intensity is carried out with reference to the Regulation of the Minister of Health of the Republic of Indonesia No. 14045 of 2002 concerning the health of the work environment and in accordance with the direction of HSE and K3 officers who are in the construction project of the Harapan Kita heart hospital. Measurements were taken with 3 readings for 5 minutes, where the measurement results remained the same from minute 1 to minute 5.

From these references and directions, it stipulates the method of measuring the intensity of lighting in the workplace using a lux meter (Extech Light Meter) and the measurement method chosen is the local lighting measurement method, where the measurement point is in a certain work area. The steps of measuring light intensity are in accordance with the Regulation of the Minister of Manpower of the Republic of Indonesia No. 5 of 2018 and SNI 16-7063-2004.

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2.2 Temperature and Humidity Measurement

2.3 Vibration Measurement

Mechanical vibration measurement refers to SNI 05-2298-1991. *Vibration* sampling will be carried out using a *vibration meter* type Benetech GM630. This vibration measurement is carried out by attaching a *vibration meter to* a tool that is a source of vibration such as a pipe *senai* machine and a *chiller* machine.

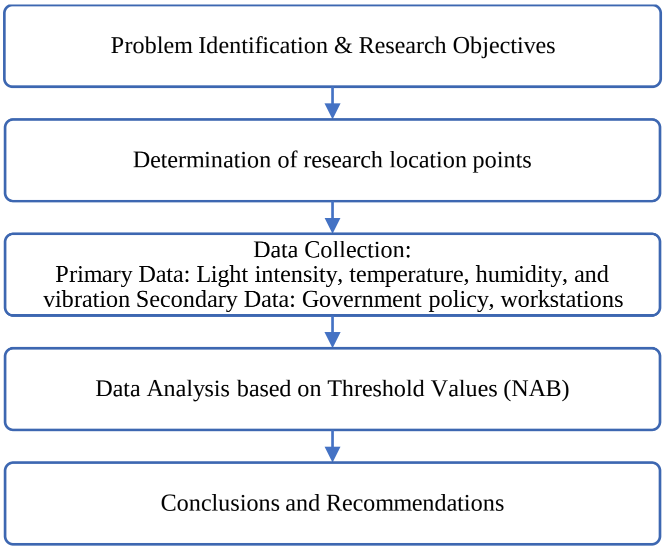

Fig 1. Research Flow Chart

2.4 Threshold Value Physical Factors of Work Environment

The threshold value, according to the Minister of Manpower Regulation No. 5 of 2018 concerning occupational safety and health, is a standard of hazard factors in the workplace as a time-weighted average level/intensity that workers can accept without causing illness or health problems on daily work for a time that does not exceed 8 hours a day or 40 hours a week (PERMENAKER RI, 2018). The following are the threshold values for lighting, temperature, humidity, and vibration under applicable regulations (Table 1).

Table 1. Threshold values for physical factors of the work environment

No.	Parameters	Threshold Value
1	Light Intensity (Lux)	200
2	Temperature (°C)	26
3	Humidity (%)	40
4	Vibration (m/s^2)	5

2.5 The Effect of Physical Factors of the Work Environment on Work Comfort

This data collection will be carried out using a questionnaire. The questionnaires were distributed to workers who were at a predetermined workstation. The questionnaires distributed amounted to 32 people according to the number of workers at the workstation. This questionnaire refers to research conducted by Regi (2013). The questionnaire can be seen in detail in Table 2 below:

Table 2. Questionnaire list of worker's subjective comfort level

No.	Question	SD	D	N	A	SA
1	In my opinion, the lighting equipment at my workstation is good enough and adequate.					
2	The lighting at my workstation supports me in completing my work.					
3	The air circulation at my workstation is good enough.					
4	I feel comfortable at work because my workstation is not hot.					
5	The humidity at my workstation does not affect my body condition at work.					
6	In my opinion, the company has provided equipment that supports comfortin carrying out work activities.					
7	I am not bothered by mechanical vibrations at my workstation.					

***SD:** Very Disagree; **D:** Disagree; **N:** Neutral, **A:** Agree, **SA:** Strongly Agree

The questionnaire will be processed and analyzed using SPSS 25 *software* with multiple linear regression methods. The purpose of the analysis is to determine the relationship or influence of physical factors on the work environment on worker comfort. The following are the steps in data processing in this study

a Validity Test

The validity test is a test used to measure whether a questionnaire is valid or not. A questionnaire is said tobe valid if the statement on the questionnaire can reveal something that will be measured by the questionnaire (Ghozali, 2018: 53). Testing the validity of this research instrument was carried out by enteringthe answers obtained from respondents distributed to workers on each variable in the *correlation* calculation in the SPSS *software* program version 25.0. If the indicator has a significant level value below or equal to 0.05, the indicator used in this study can be said to be valid, and vice versa if the indicator has a significant level value above 0.05, the indicator used in this research instrument can be said to be invalid.

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b Reliability Test

The reliability test is carried out to determine the level of stability of a tool in measuring a symptom or event.Where a questionnaire is said to be reliable if the answers to the statements are consistent or stable over time (Ghozali, 2018: 45). In this study, the reliability measurement uses a one-time measurement, which is only done once and then the results are compared with other questions in the questionnaire. According to (Ghozali, 2016) data is said to be reliable if the test results state Cronbach Alpha> 0.60. In testing reliability, this study used the Cronbach Alpha statistical test in the SPSS version 25.0 program.

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c Normality Test (Kolmogorov Smirnov)

The normality test is a test that aims to test whether in the regression model, confounding or residual variables have a normal distribution (Ghozali, 2016: 154). In this study, researchers used the *Kolmogorov-Smirnov* method to test normality. The provisions in this test if the significance of the *Kolmogorov Smirnov* test <0.05 then the data is not normally distributed.

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d Heteroscedasticity Test (Glesjer Test)

The heteroscedasticity test is conducted to test whether in the regression model there is an inequality of variance from the residuals of one observation to another (Ghozali, 2018: 137). Detecting the presence or absence of heteroscedasticity in the regression model can use several methods, one of which is the Glesjer Test method. The basis for decision-making in this test is if the significance value (Sig) is greater than 0.05, then there are no symptoms of heteroscedasticity in the regression model and vice versa.

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e Multiple Linear Regression Analysis

Multiple linear regression analysis tests is a linear relationship between two or more independent variables between (X1, X2, ..., Xn) with the dependent variable or (Y). This analysis aims to determine the relationship between the independent variable and the dependent variable and whether it is related.

Multiple linear regression analysis tests are a linear relationship between two or more independent variables between (X1, X2, ..., Xn) with the dependent variable or (Y). This analysis aims to determine the relationship between the independent and dependent variables and whether they are related.

$$Y' = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \quad (1)$$

Description:
Y : Total Score
a : Constant
b : Regression coefficient
X_1 : Light Intensity
X_2 : Temperature
X_3 : Humidity
X_4 : Vibration

f F test

In this F test, it aims to prove whether the independent variable has an effect on the dependent variable. If significant F> 0.05 then H_0 is rejected, otherwise if significant F < 0.05 then H0 is accepted. The F test hypothesis is as follows:

This F-test aims to prove whether the independent variable affects the dependent variable. If significant F> 0.05, then H_0 is rejected. Otherwise, if significant F < 0.05, then H_0 is accepted. The F test hypothesis is as follows:

H_0: Independent variables simultaneously have no effect on the dependent variable.
Ha: Independent variables simultaneously affect the dependent variable.

g T-test

According to (Ghozali, 2018) the t-statistical test basically shows how far the explanatory or independent variables individually explain the variation in the dependent variable. The decision-making basis of the t-test is as follows:

i. If Sig t count < a = 0.05 and significance value < 0.05 then partially the independent variable has asignificant effect on the dependent variable.
ii. If Sig t count> a = 0.05 and significance value> 0.05 then partially the independent variable has nosignificant effect on the dependent variable.

h Determination Coefficient Test

The coefficient of determination or R^2 in essence measures how far the ability of the model to explain the variation in the dependent variable and the coefficient of determination is between 0 and 1 (Ghozali, 2018: 97). If the results show the smaller the R^2 value, the lower the level of ability of the independent variables in explaining the dependent variable and vice versa. The coefficient of determination, or R2, essentially measures how far the model can explain variations in the dependent variable. The coefficient of determination is between 0 and 1 (Ghozali, 2018) if the results show that the smaller the value of R2, the lower the ability of the independent variable to explain the dependent variable and vice versa.

3 Results and Discussion

The operating cooperation between PT Adhi Persada Gedung and PT Pembangunan Perumahan or KSO APG - PP is a construction company in Indonesia owned by the state (BUMN). This cooperation was deliberately formed to work on the Service Building Development project (*Private and Pediatric Cardiology Wing*) of Harapan Kita Heart Hospital, owned by the Ministry of Health of the Republic of Indonesia (Adhi Persada Gedung, 2021).

1 Measurement Results of Physical Factors of the Work Environment

After determining the location of the workstation directly to the next field, measuring the physical factors of the work environment that have been determined previously. The following are results of measurements of each parameter carried out for 6 days can be seen in Table 3, and the average measurement results can be seen in Table 4 as follows:

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Table 3. Measurement Results of Physical Environmental Factors at Each Workstation

Location	Day	Light Intensity (Lux)	Temperature (°C)	Humidity (%)	Vibration (m/s^2)
Basement Floor 2 Zone B					
1	Monday	120.0	31.0	60.1	7.6
2	Tuesday	126.0	31.3	58.1	12.6
3	Wednesday	130.0	32.1	48.1	12.2
4	Thursday	132.0	31.2	53.2	12.1
5	Friday	132.0	31.1	51.0	12.4
6	Saturday	134.0	31.4	56.2	12.4
Average		129.0	31.4	54.5	11.6
4th Floor Zone B					
1	Monday	30	30.2	56.7	
2	Tuesday	31	30.2	55.6	
3	Wednesday	16	29.8	50	
4	Thursday	28	31	61	
5	Friday	36	31.6	50.3	
6	Saturday	35	31.2	58.4	
Average		29.3	30.7	55.3	
8th Floor Zone A					
1	Monday	20	28.8	70.2	13.2
2	Tuesday	20	29.8	70.6	12.5
3	Wednesday	23	29.1	70	12.4
4	Thursday	21	28.4	63	12.2
5	Friday	30	30.4	52.1	12.3
6	Saturday	35	29.6	69.6	12.7
Average		24.8	29.4	65.9	12.6
9th Floor Zone B (Electrical Installation Assembly)					
1	Monday	201	30.8	52.4	
2	Tuesday	263	32.8	49.8	
3	Wednesday	260	31.7	46.2	
4	Thursday	260	32.4	47.5	
5	Friday	264	31.4	48.1	
6	Saturday	262	32	50.2	
Average		251.7	31.9	49.0	
9th Floor Zone B (Chiller)					
1	Monday	451	30.8	56.1	3.2
2	Tuesday	537	32.8	50.5	3.6
3	Wednesday	563	31.7	47.9	3.6
4	Thursday	560	32.4	48.5	3.4
5	Friday	601	31.2	51.2	3.6
6	Saturday	577	31	56.2	3.3
Average		548.17	31.65	51.73	3.45

Table 4. Average Measurement Results for 6 Days

No.	Location	Measurements Averages over 6 days			
		Light Intensity (Lux)	Temperature (°C)	Humidity (%)	Vibration (m/s^2)
1	Basement Floor 2 Zone B	129	31.35	54.45	12.32
2	4th Floor Zone B	29.33	30.67	55.33	-
3	8th Floor Zone A	24.83	29.35	65.92	12.55
4	9th Floor Zone B	251.67	31.85	49.03	-
5	9th Floor Zone A	548.17	31.65	51.73	3.45

2 Measurement Results Comparison of Physical Factors of the Work Environment with Threshold Values

After measuring the physical factors of the work environment with the selected parameters of light intensity, temperature, humidity, and vibration for 6 days directly in the field. The next step is to make a comparison chart to find out whether the measurement value of the physical factors of the work environment at each workstation has met the threshold value set by the government. The comparison graph of each parameter can be seen in Figure 1 to Figure 4. Figure 1 shows that the workstations on the 9th-floor zone B and zone A did not meet the light intensity threshold value. Moreover, all the workstations did not meet the threshold value of temperature and humidity (Figures 2 and 3). Figure 4 shows that three workstations did not meet the threshold value of vibration: Basement floor 2 zone B, 8th-floor zone A, and 9th-floor zone A.

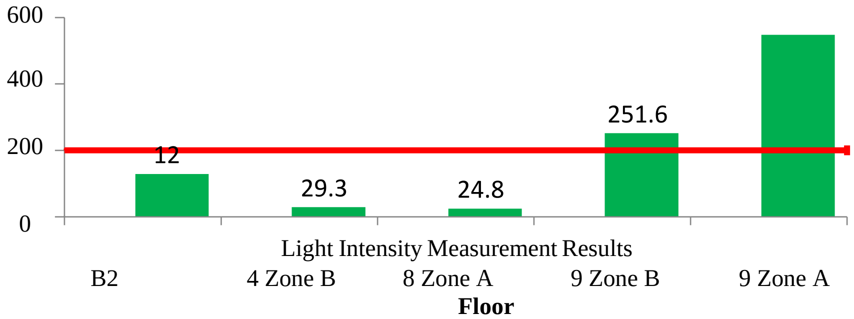

Fig 2. Light intensity measurement graph

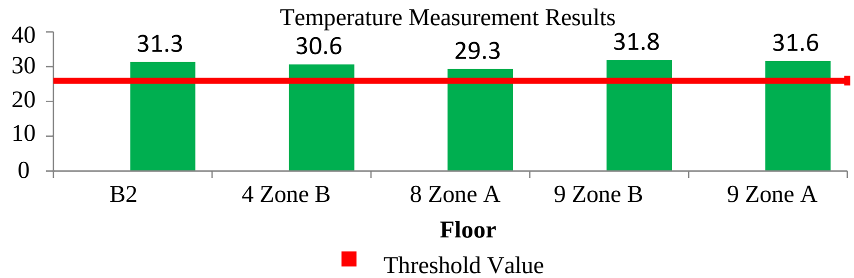

Fig 3. Temperature Measurement Chart

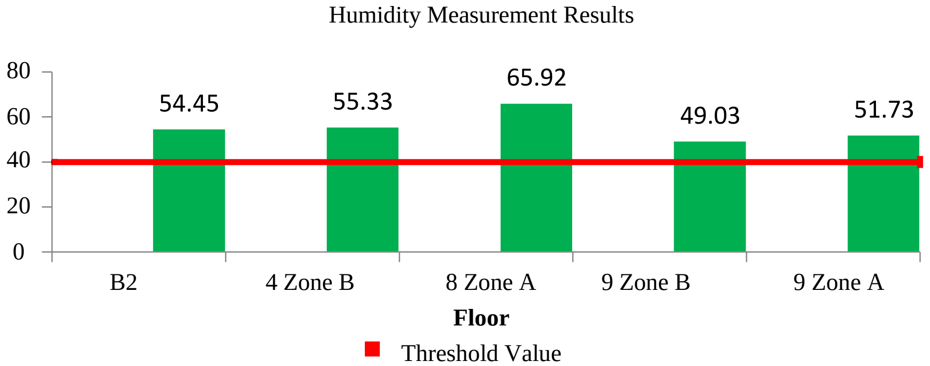

Fig 4. Humidity Measurement Chart

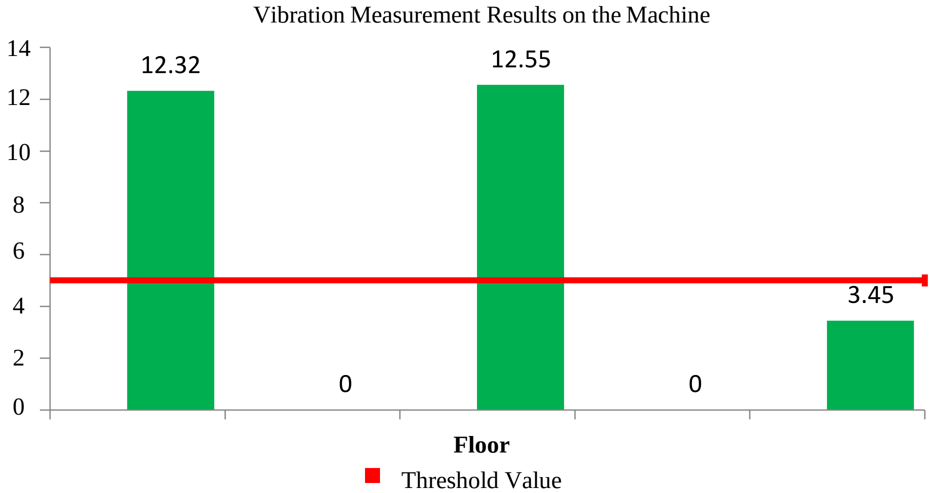

Fig 5. Vibration Measurement Graph

3 Results of Questionnaire Data Analysis

After knowing the measurement value of physical environmental factors with selected parameters at the research location, the next step is to analyze the relationship between the measurement value of physical environmental factors that have been carried out by distributing work comfort questionnaires to workers where the workstation is used as a sample data collection location. The following are the results of data processing using SPSS *software* version 25.0 and the method used is multiple linear regression:

3.1 Instrument Test

a Validity Test

Table 5. Results of the Job Comfort Variable Validity Test

Correlation				
Question		r Count	r Table	Description
Q1	Pearson Correlation	0.378	0.3494	Valid
Q2	Pearson Correlation	0.358	0.3494	Valid
Q3	Pearson Correlation	0.491	0.3494	Valid
Q4	Pearson Correlation	0.662	0.3494	Valid
Q5	Pearson Correlation	0.640	0.3494	Valid
Q6	Pearson Correlation	0.515	0.3494	Valid
Q7	Pearson Correlation	0.365	0.3494	Valid
Total Score	Pearson Correlation	1	0.3494	Valid

Based on table 5, it can be seen that the value of r count on each question has a value greater than r table.This shows that all variable items used are valid and can be used to measure the variables in this study.

b Reliability Test

Table 6. Results of the Work Comfort Variable Reliability Test

Reliability Statistics	
Cronbach's Alpha	N of Items
0.702	7

Based on table 6, it can be seen that the Cronbach alpha value in the table is 0.702. It can be concluded thatthe questionnaire in this study is declared reliable because the Cronbach alpha value is greater than 0.6.

3.2 Classical Assumption Test

a Normality Test *(Kolmogorov Smirnov)*

Table 7. Normality Test ***(Kolmogorov Smirnov)***

One-Sample Kolmogorov-Smirnov Test						
		Total Score	**Light Intensity**	**Temperature**	**Humidity**	**Vibration**
N		32	32	32	32	32
Normal Parameters[a,b]	Mean	25.3438	140.1972	30.7606	56.5972	6.9544
Std. Deviation		1.92788	158.68281	0.98195	6.32555	5.62563

Most Extreme Differences	Absolute	0.133	0.258	0.226	0.298	0.33
Positive		0.101	0.258	0.206	0.298	0.261
Negative		-0.133	-0.234	-0.226	-0.211	-0.33
Test Statistic		0.133	0.258	0.226	0.298	0.33
Asymp. Sig. (2-tailed)		.159[c]	.000[c]	.000[c]	.000[c]	.000[c]

Based on table 7 of the normality test above, after processing and analyzing the data in each variable using *SPSS Version 25.0 software*, it can be concluded that the distribution in this research questionnaire is normally distributed.

b Heteroscedasticity Test

Based on table 8, the sig. value of each parameter shows a value of more than 0.05. So it can be concluded that the regression model in this study is declared free from symptoms of heteroscedasticity.

Table 8. Heteroscedasticity Test Results with *Glesjer Test* Method

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	5.098	7.794		0.654	0.518
Light Intensity	0.001	0.001	0.229	0.907	0.372
Temperature	-0.141	0.254	-0.156	-0.555	0.583
Vibration	0.024	0.035	0.155	0.708	0.485

3.3 Multiple Linear Regression Analysis

a F-test

Table 9. F Test Analysis Results of Job Comfort

ANOVA[a]					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	50.988	4	16.996	7.409	.001[b]
Residuals	64.231	28	2.294		
Total	115.219	31			

a. Dependent Variable: Total Score

b. Predictors: (Constant), Vibration, Light Intensity, Temperature

Based on table 9, it can be seen that the Sig. F value is 0.001. If the Sig. F (0.001) > a = 0.05, then the regression analysis is significant. The value of F count (7.409) > F table (2.68) means that Ho is rejected, and Ha is accepted. This shows that the model built is good.

b T-test

Table 10. Results of the Job Comfort t-test Analysis

Independent Variable (X)	t count	t table	Sig.	Description
Light Intensity	-1.337	2.042	0.192	Not Significant
Temperature	2.481	2.042	0.019	Significant
Humidity	-1.517	2.042	0.215	Not Significant
Vibration	3.572	2.042	0.001	Significant

c Determination Coefficient Test

Table 11. Results of the Coefficient of Determination Test Analysis

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.665[a]	0.443	0.383	1.51458
a. Predictors: (Constant), Vibration, Light Intensity, Temperature				

Based on Table 11, the coefficient of determination or *R Square* is 0.443 or 44.3%. So it can be concluded that 44.3% of the variable physical factors of the work environment affect the comfort of work comfort. While the difference of 55.7% is influenced by other factors that are not included in this study

3.4 Recommendation for Improvement

After measuring the physical factors of the work environment such as light intensity, temperature, humidity, and vibration, then analyzing the data and comparing it with the applicable threshold value (NAB) according to each parameter, it turns out that there are still physical environmental factors that are still not in accordance with the threshold value (NAB) such as light intensity, temperature, and vibration. Therefore, itis necessary to take corrective steps so that the work environment is created comfortably. The suggestions forimprovement recommendations are in accordance with the hazard control hierarchy in OHSAS 18001: 2007, namely elimination, substitution, engineering, administration, and personal protective equipment. Elimination cannot be used in this control because the source of danger cannot be eliminated because the tools that cause the health hazard are needed by workers to do the job. While substitution control can be donesuch as replacing tools that have smaller vibrations or changing the wattage of lights, the company cannot replace them due to limited costs to replace these tools. So from this, the controls that are in accordance with this research are as follows:

As shown in Figure 1 to Figure 4, physical environmental factors do not meet the threshold value, such as light intensity, temperature, and vibration. Therefore, it is necessary to take corrective steps to create a work environment comfortably. The suggestions for improvement following the hazard control hierarchy in OHSAS 18001: 2007, namely elimination, substitution, engineering, administration, and personal protective equipment. Elimination cannot be used in this control because the source of danger cannot be eliminated because the tools that cause the health hazard are needed by workers to do the job. While substitution control can be done, such as replacing tools that have lesser vibrations or changing the wattage of lights, the company cannot replace them due to limited costs to replace these tools. The detail recommendations control are as follows:

1 Engineering Control

The condition of the work environment at the Harapan Kita Jakarta Heart Hospital construction project is classified as a hot category, with an average temperature ranging from 31.35 °C to 31.65 °C with an average humidity ranging from 51.73% to 65.92%. This temperature is not following the threshold value set by the government in PERMENAKER No.5 of 2018. One of the improvements the company's HSE management can make to overcome high temperatures is to make temporary air ventilation holes or provide *portable blower fans at* each workstation. One of the improvements that the company can make for the vibration parameter is to modify the engine holder by using rubber pads so that the vibration generated by the engine is well-damped.

2 Administration

For administrative control, the company can organize OSH training to add workers' insights or work techniques according to the work and conditions at each workstation and avoid the potential for work accidents, as well as anticipation for handling conditions in the field. In addition, company management can provide instructions/recommendations for workers to maintain body condition by exercising regularly, eating a healthy diet, and drinking patterns to keep workers' body fluids well supplied. Another thing that can be done by company management is to improve workers' working hours or monitor the quality of physical factors in the work environment at each workstation (Sunaryo & Rhomadhoni, 2020).

3 Personal Protective Equipment

Recommendations for improvements to overcome poor lighting are by facilitating good lighting at each workstation or providing facilities such as headlamps to workers so that they can maneuver freely without having to worry about the lack of lighting on their work objects. In addition, in dealing with high temperatures, company management can provide workers with heat-resistant clothing to reduce heat, use UVB/UVA protective glasses, and wear project helmets that have the advantage of reflecting light and providing an excellent effect to the wearer (Ilie, 2021).

Finally, related to vibration, the company management can overcome it by facilitating workers with personal protective equipment (PPE), such as gloves or vests with a specific thickness, to reduce the vibration produced by the machine (Kurniawati, 2013).

4 Conclusion

Based on the measurements of the physical factors of the work environment carried out at the five workstations, namely on the basement floor 2 zone B, floor 4 zone B, floor 8 zone A, floor 9 zone A, and zone B, for the measurement results of the parameters of light intensity, temperature, and vibration are still not met the threshold value set by the government. However, the humidity parameter still follows the predetermined threshold value. Furthermore, the results of multiple regression analysis showed that the temperature and vibration parameters significantly influence work comfort. In contrast, the parameters of light intensity and humidity do not significantly influence work comfort. Therefore, to improve the physical work environment, the recommendation was referred to the hazard control hierarchy in OHSAS 18001: 2007. Light intensity parameters can be improved by providing additional lights or facilitating workers with *safety headlamps.* For temperature parameters, the company can instruct workers to maintain drinking patterns to maintain body fluids, wear comfortable clothes, or facilitate workers with *blower fans at* each workstation. Moreover, for vibration, the company can make a machine holder made of rubber to reduce the vibration produced by the machine.

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